

AT

DEPARTMENT OF HEALTH AND HUMAN SERVICES

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FOOD AND DRUG ADMINISTRATION

DENTAL PRODUCTS PANEL MEETING

OPEN SESSION

VOLUME II

Tuesday, November 4, 1997

9:05 a.m.

Holiday Inn Bethesda
8120 Wisconsin Avenue
Bethesda, Maryland

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Robert J. Genco, DDS, Ph.D., Acting Chairperson
Pamela D. Scott, Executive Secretary

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Mark R. Patters, DDS, Ph.D.
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Floyd Larson (Industry Representative)
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John Brunski, Ph.D.
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Leslie Heffez, DMD, MS
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FDA

Susan Runner, DDS, MA
Angela Blackwell, MS (Issue 1)
Sandy Shire, DMD, (Issue 2)

GUESTS

Barry Hendler, DDS, M.D. (Issue 2)
Eric Furst, M.D. (Issue 2)
Glenn T. Clark, DDS (Issue 2)

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1 P R O C E E D I N G S

2 DR. GENCO: We are going to spend the greater part
3 of the day discussing endosseous dental implant subgroups,
4 and I would like to introduce Ms. Pamela Scott, who is the
5 Executive Secretary of the Dental Products Panel. Pamela?

6 MS. SCOTT: Good morning to everyone and welcome
7 to our Dental Products Panel meeting today.

8 If you have not signed in, please do so at our
9 sign-in desk just outside the room. At the sign-in desk you
10 will find our agenda, hopefully, and information on
11 obtaining a transcript of today's meeting.

12 At this time, I would like to introduce our Panel
13 members and consultants that are serving today. Our Acting
14 Chair is Dr. Robert J. Genco. He is distinguished Professor
15 and Chair at the Department of Oral Biology with the School
16 of Medicine at the State University of New York at Buffalo.
17 We also have Dr. Janine Janosky. She is Assistant Professor
18 of the Department of Family Medicine and Clinical
19 Epidemiology with the School of Medicine at the University
20 of Pittsburgh. We have Dr. Mark Patters, who is the Chair
21 of the Department of Periondotology, College of Dentistry at
22 the University of Tennessee. We also have Dr. Willie
23 Stephens. He is Associate Surgeon for the Division of
24 Maxillofacial Surgery at Brigham and Women's Hospital.

1 Our consumer representative is Dr. Donald Altman.
2 He is the Chief of the Office of Oral Health with the
3 Arizona Department of Health Services. Our industry
4 representative is Mr. Floyd Larson, and he is the President
5 of Pacific Materials and Interfaces.

6 We also have with us today serving as Panel
7 consultants Dr. John Brunski. He is Professor of Biomedical
8 Engineering at Rensselaer Polytechnic Institute. We also
9 have Dr. James Drummond. He is Professor of Restorative
10 Dentistry at the University of Illinois at Chicago. We have
11 with us Dr. Leslie Heffez, who is Professor and Department
12 Head of Oral and Maxillofacial Surgery, University of
13 Illinois at Chicago. We have Dr. George McCarthy, who is
14 the Chief of the Commissioned Officers Dental Clinic with
15 the National Institutes of Health. We have Dr. Andrea
16 Morgan, who is a Clinical Instructor for the Department of
17 Restorative Dentistry at the University of Maryland Dental
18 School. We also have Dr. Diane Rekow who is the Chairperson
19 of the Department of Orthodontics with the University of
20 Medicine and Dentistry of New Jersey.

21 The next items of business are several statements
22 that are to be read into the record. The conflict of
23 interest statement: The following announcement addresses
24 conflict of interest issues associated with this meeting,

1 and is made part of the record to preclude even the
2 appearance of an impropriety.

3 To determine if any conflict existed, the Agency
4 reviewed the submitted agenda and all financial interest
5 reported by the committee participants. The conflict of
6 interest statutes prohibit special government employees from
7 participating in matters that could affect their or their
8 employers' financial interests. However, under the final
9 rule on 18 USC 208 acts affecting a personal financial
10 interest, Title V CFR Part 2640, published December 18, 1996
11 in the Federal Register, Volume 61, Number 244, a special
12 government employee may participate in any particular matter
13 of general applicability where the disqualifying financial
14 interest arises from his non-federal employment, or from a
15 de minimis stockholding.

16 Since the agenda items for this session involve
17 particular matters of general applicability, the Agency has
18 determined that Dr. Robert Genco, Dr. Elizabeth Rekow, Dr.
19 John Brunski and Dr. James Drummond may participate fully in
20 the discussions.

21 We would like to note for the record that the
22 Agency took into consideration certain matters regarding Dr.
23 Janine Janosky and Dr. George McCarthy. Dr. Janosky
24 reported a past interest in a firm at issue but on a matter

1 unrelated to the issues before the Panel. Dr. McCarthy
2 reported an interest but no financial involvement in a
3 device at issue. Since neither has a current financial
4 involvement, the Agency has determined that Dr. Janosky and
5 Dr. McCarthy may participate fully in all discussions.

6 The Agency would also like to note for the record
7 that Dr. Barry Hendler, a guest here today, has reported a
8 financial interest in one of the firms manufacturing anti-
9 snoring sleep apnea devices.

10 In the event that the discussions involve any
11 other products or firms not already on the agenda for which
12 an FDA participant has a financial interest, the participant
13 should excuse him or herself from such involvement, and the
14 exclusion will be noted for the record.

15 With respect to all other participants, we ask in
16 the interest of fairness that all persons making statements
17 or presentations disclose any current or previous financial
18 involvement with any firm whose product they may wish to
19 comment upon.

20 The second statement is the appointment to
21 temporary voting status. Pursuant to the authority granted
22 under the Medical Devices Advisory Committee Charter, dated
23 October 27, 1990, as amended April 20, 1995, I appoint the
24 following people as voting members of the Dental Devices

1 Panel for this Panel meeting, November 4 through 5, 1997:
2 Dr. Diane Rekow, Dr. Andrea Morgan, Dr. James Drummond, Dr.
3 Leslie Heffez. For the record, these people are special
4 government employees and are consultants to this Panel under
5 the Medical Devices Advisory Committee. They have undergone
6 customary conflict of interest review. They have reviewed
7 the material to be considered at this meeting. Signed, Dr.
8 Bruce Burlington, Director for the Center of Devices and
9 Radiological Health, October 28, 1997.

10 At this time, I would like to turn the discussion
11 over to Dr. Genco.

12 DR. GENCO: Thank you, Ms. Scott. We will now
13 have an open public hearing on the topic of reclassification
14 of endosseous dental implant subgroups. Anyone from the
15 public can address the Panel with respect to this topic.
16 Speakers are asked to state whether or not they have any
17 involvement, including financial or other involvement, with
18 manufacturers and products being discussed today or with
19 their competitors.

20 Are there any comments from the public? Is there
21 anyone who would like to make a comment? If not, we will
22 proceed with the FDA presentation. I would like to
23 introduce Dr. Susan Runner, who is the Branch Chief of the
24 Dental Devices Branch, and Angela Blackwell, who is a

1 biomedical engineer with the Dental Devices Branch, to give
2 us some orientation to today's activities. Dr. Runner?

3 **Presentation by Dr. Susan Runner**

4 DR. RUNNER: Today, we are going to discuss an
5 issue that has been discussed at the Agency for quite a
6 number of years. The issue is the classification or
7 reclassification of subgroups of various endosseous dental
8 implants for partial or complete rehabilitation of the oral
9 cavity.

10 I would like to begin with a brief history of the
11 classification effort. Originally, in 1976, the Dental
12 Products Panel recommended that endosseous implants be
13 classified into class III. The Agency then issued a final
14 classification of endosseous implants into class III in
15 1987.

16 At that time, the Panel felt that there was
17 insufficient information to determine safety and efficacy of
18 this device based on the information that was available at
19 that time. Subsequently, the Agency was petitioned to
20 consider down-classification of all types of endosseous
21 implants into class II. The Dental Advisory Panel again met
22 and, at that time, considered the issue and determined that
23 uncoated, screw type implants for use in the anterior
24 mandible should be down-classified to class II. All other

1 types of implants were left in class III.

2 That sort of brings us up to date. That decision,
3 however, was over five years ago. The Dental Branch, as you
4 probably know, is composed of clinicians, engineers,
5 biologists and other professional reviewers. We have a
6 continuing, ongoing relationship with industry, the academia
7 and the research community. We felt through our
8 interactions that the knowledge in the field has grown
9 significantly since that indication or that recommendation
10 was made by the Panel.

11 In an effort to be proactive after such a long
12 period of time, the Dental Branch felt that it was
13 appropriate to revisit this very important issue. As you
14 know, oral rehabilitation with the use of endosseous
15 implants has grown significantly and is considered to be an
16 acceptable standard of care in the dental oral health
17 community.

18 We would like the Panel today to consider the
19 information that is available on the various levels of
20 scientific evidence that may allow reclassification of
21 certain subtypes of endosseous implants. We realize that
22 bringing this issue today to you has generated a significant
23 amount of interest in the research community and industry,
24 and that there are exceedingly large amounts of material

1 that have been sent about this issue.

2 We do not want you to rush to a final decision.
3 You should consider this meeting a beginning. We want you
4 to discuss the issue until all relevant views and
5 information have been presented, and this means that we
6 probably will not complete discussion of this issue today
7 and we will consider it further at the next Panel meeting,
8 in January.

9 Your charge then today is to consider the
10 information that is presented to you, ask questions and
11 determine any additional information that is needed. Thank
12 you very much.

13 I would like now to introduce Ms. Blackwell, who
14 is a biomedical engineer in our Branch, and she will present
15 to you our preliminary grid of the types of endosseous
16 implants that we see in our 510(k) applications. This grid,
17 as she will explain to you, is only preliminary. It can be
18 changed; it can be altered by the Panel if they feel it
19 necessary.

20 **Presentation by Ms. Angela Blackwell**

21 (Slide)

22 MS. BLACKWELL: For the purposes of
23 reclassification, there are 15 types of implants. Machined
24 and/or grit blasted screws, cylinders and hybrids are the

1 first subgroups.

2 Hybrids are implants that have some
3 characteristics of screws, like threads, and some
4 characteristics of cylinders, like an implant body with
5 straight sides. There are porous ceramic coated screw,
6 cylinders and hybrids.

7 Porous coatings, coatings with volume porosity
8 greater than 10%, can be split into two subgroups. First
9 are those coatings which allow bone ingrowth or biological
10 fixation. The CFR defines biological fixation for porous
11 metallic coated hips in CFR 888.3358. These coatings have a
12 volume porosity of 30% to 70%, an average pore size of 100-
13 1,000 microns, interconnecting pores and a coating thickness
14 of 500-1500 microns. This definition of porous coatings for
15 biological fixation is applicable to dental implant coatings
16 as well as hips, except for the coating thickness which
17 would be reduced due to the small size of dental implants.
18 A more appropriate coating thickness for dental implants
19 would be in the range of 100-500 microns.

20 The second group of coatings are those which are
21 porous, but do not fit the above definition of biological
22 fixation.

23 We also have porous metallic coated screw,
24 cylinders and hybrids; nonporous metallic coated screws,

1 cylinders and hybrids. Nonporous coatings are intended to
2 roughen the surface, and their porosity is generally very
3 low, less than 10%.

4 (Slide)

5 The next group is implants with special retention
6 features. These implants have some component of their
7 design that makes them substantially different from standard
8 screws, cylinders or hybrids. Examples of this would be a
9 movable part for increased retention, or a design to allow
10 the implant to be placed in a different location than the
11 usual system.

12 We also have blade implants and temporary implants
13 that are for use for nine months or less.

14 (Slide)

15 There are six indications to be considered at this
16 time. There are two-stage implants which involve two
17 surgeries; one-stage which involves one surgery. This is
18 also called non-submerged by some clinicians; one-stage with
19 immediate loading; one-stage with loading after less than
20 three months of healing; two-stage with zygomatic bone
21 anchoring; and fresh extraction sites.

22 Please note that not all implant types are for all
23 indications. There are some indications the FDA has been
24 asked about, especially those concerning using implants with

1 other devices, which will not be addressed at this time. If
2 the Panel has a specific indication you wish added to the
3 list, please let us know so we can request the data relating
4 to it for a later meeting.

5 Please consider the following questions as you
6 listen to the presentations: As we consider down-
7 classification of endosseous implants, should we continue to
8 consider implant location in the oral cavity as a component
9 of the device's indication for us?

10 Based on information reviewed by the Panel, what
11 implant types may be grouped together for the purpose of
12 reclassification?

13 (Slide)

14 For an example, see the compressed version of the
15 grid with a sample box filled in. You can see the sample
16 box right under two-stage. Note that the compressed version
17 has the different implant types with the same surface
18 treatments or coatings grouped together. Grouping types
19 together for reclassification does not mean they will all
20 necessarily have the same classification. They are grouped
21 because their common characteristics make for a convenient
22 way to organize for looking at the data available.

23 Question three, abutments are sold both separately
24 and with an implant system. Should abutments be classified

1 separately from the implant fixture? What is needed to
2 provide reasonable assurance of safety and effectiveness for
3 abutments that are sold separately?

4 What additional information would be helpful to
5 the Panel prior to the next Panel meeting?

6 Just a note, dental implant accessories will not
7 be considered at this time because the FDA, on its own
8 initiative, is proposing to reclassify them to class I
9 exempt. This is for all implant accessories which are used
10 in the mouth for less than one hour. This Federal Register
11 Notice is already in development.

12 Are there any questions?

13 DR. GENCO: Thank you, Ms. Blackwell. Are there
14 comments from the Panel? Angela, the fourth category, one-
15 stage with loading after less than three months, do you want
16 to expand on that? How does that differ from the one-stage
17 immediate loading?

18 MS. BLACKWELL: With immediate loading there is no
19 healing time at all. In other words, you load it
20 immediately after surgery. After three months means you
21 just have a short healing time.

22 DR. GENCO: All right, and that is distinct, of
23 course, from the two-stage where the healing time is four to
24 six months?

1 MS. BLACKWELL: Yes.

2 DR. GENCO: Thank you. Susan, did you want to
3 comment?

4 DR. RUNNER: I was just going to say that if you
5 feel that these could be compressed, that is certainly
6 acceptable. We are using these indications as what we have
7 seen in our applications.

8 DR. GENCO: Thank you. Any other comments or
9 questions?

10 (No response)

11 Thank you very much. We will now proceed to
12 representatives from industry and organizations who will
13 give us some food for thought here relative to this issue of
14 subgroups within this generic classification of endosseous
15 implants.

16 Our first speaker is Dr. Alan Balfour. Dr.
17 Balfour, would you come up to the podium and identify
18 yourself, who your work for and what your interests are?
19 Each of the speakers has ten minutes and then we would like
20 to have a chance to talk to them for another five for
21 discussion. I would ask all the speakers to try to keep on
22 time. We have something like fourteen presentations between
23 now and tea time this afternoon.

24 **Presentation by Dr. Alan Balfour**

1 DR. BALFOUR: Good morning.

2 (Slide)

3 My name is Alan Balfour. I am from Balfour
4 Medical Consultants. I have been in the dental implant
5 industry for over ten years with a variety of companies, and
6 now I am independent consultant in this industry. This
7 morning, what I will be talking about and discussing is some
8 of the mechanical aspects of dental implants and their
9 relationships to classification. What I want to do is talk
10 a little bit about the standards for the functional and
11 structural testing and the requirements for 510(k)s, as well
12 as what classifications of those should be.

13 (Slide)

14 Standards for functional and structural testing of
15 endosseous dental implants -- what are the patient and
16 clinical functional standards? I think what we look to is
17 to restore the masticatory function, maintain the bone mass
18 and eliminate pain and provide esthetics. Those are some of
19 the key features, key areas we want to look at when we are
20 giving something to a patient.

21 (Slide)

22 Restoring the masticatory function requires that
23 we provide the patient with a correctly aligned occlusal
24 plane and provide for mechanically sound and functional

1 implant prosthetic design that functions under normal
2 occlusion.

3 (Slide)

4 What are the standards for structural testing and
5 design of dental implants? Presently there are a variety of
6 methods for testing mechanically to look at implant bodies.
7 What I will be talking about in the mechanics has a direct
8 reflection on what the results would be on the implant, and
9 whether one implant will work in a certain area or won't
10 work in a certain area, and the long-term success.

11 (Slide)

12 So what we have to look at is what the minimum
13 occlusal force that a dental implant in its prosthetic
14 restoration must withstand; what forces exist in the mouth
15 and how we control those forces.

16 (Slide)

17 Under normal occlusion, forces have been
18 registered in the mouth from a variety of literature.
19 Brunski showed between 90-43 lbs of force; Haraldson Jemt 30
20 lbs; Helkimo Carlsson, 40 lbs; Laurell, 59-72 lbs; and Neill
21 Kydd, 24-37 lbs. So, we can get a general idea of the type
22 of forces that are in the mouth. We have seen recorded
23 forces in some of the literature of 800 lbs. of force. We
24 have to be a little skeptical of this and understand what

1 loads can actually be applied because that will determine
2 how we can design an implant and what the standard should be
3 for an implant body and the restoration.

4 (Slide)

5 What type of occlusal force can be transferred to
6 an implant as a cantilever force? This is the other
7 important part of designing the implant and getting to
8 understand the specifications of an implant.

9 (Slide)

10 Under a cantilever force, if it was on a single
11 implant below that we saw before with the kind of forces
12 that are applied on a single implant, or if we even tied
13 those implants together, the force that you apply would be
14 the force that the implant would have to withstand. As soon
15 as we start to go with cantilever pontics, and this is the
16 part of the field where I have been involved with, and
17 industry as well, is seeing the failures and looking at the
18 types of implant failures that have occurred through the
19 years. What we see a lot of is overloaded cases as soon as
20 they start to build pontics on these. Just by using simple,
21 basic engineering we start to make a cantilever, when you
22 look at implant one and implant two, the force on implant
23 one has a significantly higher applied force, three times
24 the amount of force. Then implant two has a tensile force

1 that also has higher than applied force. So if you build an
2 implant that has to withstand only 100 lbs. of force but now
3 you did three times that, the implant would never be able to
4 withstand that kind of load.

5 (Slide)

6 Under overload on a dental implant, what failure
7 modes have been documented?

8 (Slide)

9 What has been seen as the cause for implant
10 failure showed that implants that are connected to natural
11 teeth we see as a mode of failure. The reason I believe
12 this is occurring is because we are building cantilevers.
13 We are building loads that are distal to the implant because
14 the tooth has the ability to flex, whereas the implant
15 doesn't. Excessive off-axis implant occlusion, again,
16 generates a cantilever when we go off-axis. Posterior
17 mandibular free-standing implants, a large crown, small root
18 ends up being a cantilever load, again, putting excessive
19 load onto the implant body, and then excessive cantilever
20 occlusion building pontics onto the implant.

21 (Slide)

22 Implant fractures caused by implant overload, as
23 shown by Rangert. He looked at 39 cases that suffered
24 implant failures, single and multiple fractures.

1 (Slide)

2 What he saw was that 77% were supported by one or
3 two implants subjected to cantilever. This was cumulative.
4 And 90% of fractures occurred in the posterior region, both
5 conditions being issues of overloading due to the cantilever
6 loads.

7 (Slide)

8 Twenty-two percent of the fractures occurred in
9 prostheses supported by implants connected to natural teeth.
10 Then the last one, which is the most important one I
11 believe, 92% of the fractures occurred when the bone level
12 was reported to be 3 or more threads towards the apex of the
13 implant. In other words, bone was being lost. Why was bone
14 being lost? Because some of these were under extreme load.
15 You can design an implant to withstand a lot of force.
16 Titanium is a very strong material. But will the bone be
17 able to withstand those kind of loads? You can design all
18 sorts of sizes of implants but the important thing is to
19 understand what goes on top of the implant, and to subject
20 an implant to rigorous classifications and understanding of
21 sizing and things like that -- it is important to understand
22 what is being put on top, not necessarily what the implant
23 is.

24 (Slide)

1 Let's look at the mechanical properties of bone
2 versus titanium. Why do we see that bone is being lost?
3 Well, bone is being lost because the ultimate strength and
4 fatigue characteristics of bone and resorption occur at a
5 lot lower level than titanium would. We can see there is a
6 factor of 10 on the modulus and an ultimate strength of a
7 factor 5 of commercially pure alloyed titanium as a factor
8 of 10.

9 (Slide)

10 So, what should we do to set the standards for
11 designing dental implants? What we need to do is look at
12 the literature and understand the normal occlusal forces
13 that an implant is under. There is a lot of literature that
14 has been published. I think in general what we see is that
15 loads are in the range, I would say in general, of about 75
16 lbs. of load as a maximal occlusal force. Then we have to
17 sort of define a safety factor. We need to put a safety
18 factor in there and say, okay, under those kinds of loads I
19 want a safety factor of 2, so, to set a minimum standard of
20 150 lbs. of force should be the minimum to the implant to
21 withstand the load.

22 (Slide)

23 I can't control a user to tell him or stop him
24 from putting multiple implants. They do it all the time. I

1 have seen cases after cases. We tell them not to do it and
2 they will do it. But to say you are going to be able to
3 design any implant to withstand 1,000 lbs., that will not
4 happen but you can generate those kinds of loads as soon as
5 you generate cantilevers.

6 (Slide)

7 So, what structural testing would be done to
8 evaluate a new implant design? I am proposing the following
9 minimum tests, that is, to do compressive bending and impact
10 load; torsional loading; load to failure to look at the
11 implant abutment connection under single tooth restorations;
12 and then compressive fatigue to define the infinite life of
13 the system.

14 (Slide)

15 Under compressive bending, what would be the test
16 setup? I published this in the Journal of Prosthetic
17 Dentistry. I believe it was in '95, but I have used this
18 protocol for a variety of 510(k)s for years. Varying even
19 just the test setup can result in different results. So
20 what I am saying is to at least set a standard as well for
21 the type of testing and the test protocol. That would be to
22 have an implant abutment that is assembled at a defined
23 assembly torque depending on the manufacture in general; 30
24 cm of torque is right around a standard. Remove any thread,

1 in other words, when you go to test it, rescrew the
2 components together. After a couple of minutes the thread
3 relaxes over time. So, it needs to be rescrewed in. We
4 should also say that to our doctors. Set the test fixtures
5 off-axis at 30 degrees to the vertical load. This will
6 generate your cantilever. This also generates a worst-case
7 scenario. We need to look at the worst-case scenario
8 because implants are not always placed on axis, especially
9 in the anterior. Use a restoration that is 8 mm tall for an
10 average size tooth. Set the implant 1 mm off fixture. In
11 general, what we see is a millimeter bone loss during what
12 is termed a biological gap.

13 (Slide)

14 The same situation for torsional loading.
15 Assemble at 30 cm. Remove thread embedment. Set the
16 component implant body 1 mm above the fixture and then
17 unscrew the abutment from the implant using a calibrated
18 torque meter.

19 (Slide)

20 Lastly, for compressive fatigue testing setup.
21 Again, assemble the components at a defined torque. Remove
22 the thread embedment. Set the fixture off-axis and, again,
23 use an 8 mm restoration and keep the implant 1 mm off the
24 fixture. Cycle for infinite life, which has been defined as

1 5 million cycles where the curve becomes flat. That is what
2 we are defining as infinite life. People say you should go
3 to 10 million, 2 million -- anywhere there is a flatness to
4 the curve, that become the infinite life. That becomes the
5 SN curve.

6 With this, I would like to, hopefully, get some
7 type of understanding that this is what the implants should
8 withstand as a minimum.

9 DR. GENCO: Thank you very much, Dr. Balfour.

10 DR. BALFOUR: Thank you.

11 DR. GENCO: Are there any questions of Dr. Balfour
12 from the Panel? Comments? I can't see you at the ends of
13 the table so let me know if you want to talk. John?

14 DR. BRUNSKI: Alan, just a question. You reviewed
15 some of the force data that is available in the literature,
16 and you were describing how to work it into our testing
17 methods for implants. Do you have any recommendations as a
18 consultant to manufacturers who may come to you concerning
19 bending moment? Do you have any feeling as to what the
20 implant should be able to withstand in terms of bending
21 moment?

22 DR. BALFOUR: So, are you saying what cantilever
23 should be acceptable?

24 DR. BRUNSKI: Not necessarily that. I mean in

1 terms of the strength characteristics of implants, whatever
2 the cantilever might be when you come to the implant there
3 can be a bending moment on a given implant --

4 DR. BALFOUR: Right.

5 DR. BRUNSKI: I guess what I am asking is do you
6 think our guidance documents and the information that the
7 FDA has are sufficient in terms of determining what is a
8 safe versus dangerous value of those kinds of bending
9 moments?

10 DR. BALFOUR: That is a hard question to answer
11 because of different qualities of bone but, yes, that would
12 definitely have an impact on the length of the implant
13 because that would generate how much stress would be at the
14 apex of the implant versus as it goes down. People are
15 looking at designs to more uniformly distribute that stress.
16 But it is hard because I think biologically you are in
17 different qualities of bone, and biologically those
18 different qualities of bone define how much bending moment
19 each one of those implants can withstand. I think in the
20 literature they show -- and I have a presentation to go into
21 that detail of what stress different qualities of bone can
22 withstand, and I don't have a defined number that says,
23 okay, you know, this should withstand this much bending
24 moment because it will be determined basically by the

1 quality of the bone and the length of the implant and
2 diameter as well. So, it is a hard question to answer.

3 DR. GENCO: Any further questions or comments?
4 Mr. Larson?

5 MR. LARSON: With regard to standards, I recognize
6 that international standards can be a useful tool to us in
7 the special controls arena, and just an update, in Bangkok
8 ISO TC 106 we recently made some significant progress in
9 establishing a fatigue testing standard. One of the major
10 items of progress was that the method that has generally
11 been used in submissions to the FDA was adopted as the
12 method in the draft standard. So, there is still some
13 development to go, and, Dr. Brunski, we need to bring you
14 into that process as well but, at least, there is some
15 progress being made. Now, it is a test method standard; at
16 this point it is not a performance standard.

17 DR. GENCO: Thank you. Dr. Balfour, thank you
18 very much. The next speaker is Dr. Charles Babbush, and he
19 is representing Dental Implant Manufacturers Association.
20 Dr. Babbush?

21 **Presentation by Dr. Charles Babbush**

22 DR. BABBUSH: My name is Charles Babbush, and I am
23 an oral and maxillofacial surgeon from Cleveland, Ohio. I
24 have appeared before this Panel in 1978 and in 1991. I

1 would like to thank you for this opportunity to express my
2 views and opinions as a representative of the Dental Implant
3 Manufacturers Association as they related to endosteal
4 implant devices. This statement is not concerned with legal
5 issues, and is made without prejudice to any legal position
6 which DIMA might decide to take.

7 Next year will mark the 30th year since I placed
8 my first endosteal implant. It was a blade implant from
9 Park Dental Research. Over those years I have worked and
10 used dental implants in all of their phases -- research and
11 development, laboratory and animal studies, clinical trials,
12 as well as clinical use and experience, lecturing, teaching
13 and writing.

14 Those implants used during these almost 30 years
15 include endosteal one-stage blade vents, mandibular
16 subperiosteal bone plate, mandibular staple bone plate,
17 various one-stage endosteal root forms, ramus frame, mucosal
18 inserts, one-stage osseointegrated titanium screws, hollow
19 cylinders and two-stage osseointegrated root form cylinders
20 with titanium-coated or HA coatings, as well as two-stage
21 osseointegrated threaded root forms.

22 My positions and affiliations include but are not
23 limited to being a Diplomat of the American Board of Oral
24 and Maxillofacial Surgery; Director of the Dental Implant

1 Center at Mt. Sinai Medical Center, and an Associate
2 Clinical Professor at Case Western Reserve University in
3 Cleveland, Ohio. I am a visiting Professor at the
4 University of Miami Jackson Hospital and Nippon Dental
5 University, Niigata, Japan.

6 I was also Chairman of the Special Committee on
7 Dental Implants for the American Association of Oral and
8 Maxillofacial Surgeons, as well as one of its official
9 spokespersons.

10 I am a past President of the American Academy of
11 Implant Dentistry, as well as a Credentialed member and a
12 Fellow.

13 I am a founding member of the International
14 congress of Oral Implantologists, and a member of the
15 Academy of Osseointegration, and have served on several of
16 their committees.

17 I have presented over 650 lectures and seminars on
18 the subject of implant reconstruction, at most major dental
19 meetings in this country and at most major universities
20 nationally and internationally.

21 I have authored over 40 journal articles related
22 to implants, and I have written 20 chapters in prominent
23 textbooks that are available today. In addition, I have
24 authored two textbooks in the field, Surgical Atlas of

1 Implant Techniques , in 1980, and recently, Dental Implants:
2 Principles and Practice . I am currently writing my third
3 textbook.

4 I am, and have been, on the editorial board of
5 several scientific dental journals including Journal of Oral
6 Surgery , International Journal of Oral and Maxillofacial
7 Implants , Practical Periodontics and Aesthetics , Journal of
8 the American Dental Association , Implant Dentistry , Dental
9 Implant Update and Dental Implantology .

10 Historically, as a clinician, I have always
11 reported and published my clinical results, and in so doing,
12 I would like to relate to you my results with two-stage
13 osseointegrated root form cylindrical implants, which is
14 available in Dental Implants: Principles and Practice , as
15 well as The Journal of Oral Surgery .

16 I have kept similar records, based on Kirsch's
17 initial six indications for the IMZ press fit cylindrical
18 implant. My experience with the IMZ implant started in
19 1985, carrying through December 1990, and is still ongoing
20 today. I used the Cutler, 1958 publication in the Journal
21 of Chronic Disease , "Maximum Utilization of the Life Table
22 Method in Analyzing Survival." This was also used in the
23 first article published on dental implants by me using life
24 table survival methodology, "Titanium Plasma Spray Screw

1 Implant for Reconstruction of the Edentulous Mandible." in
2 the Journal of Oral Surgery, 1986. This was an eight-year
3 follow-up of over 1,700 implants from four different
4 countries.

5 Life table analysis makes possible the use of all
6 survival information accumulated up to the closing date of
7 the study. In this way, I felt I could include all
8 information in the presentation.

9 This material was recommended and reviewed by Dr.
10 Ralph Kent, Biostatistician of Forsyth Dental Center, and
11 one of this country's leading biostatisticians.

12 These data have been published in the
13 International Journal of Oral and Maxillofacial Implants in
14 1993. During the five-year study period I placed 1,059
15 implants in 322 cases. Twenty-one implants were lost-to-
16 follow-up and 28 implants failed, including only nine which
17 did not integrate during the first stage.

18 Of 19 failures, I can only relate to one implant
19 system failure, and that was one fractured implant out of
20 the 1,059 placed.

21 The cumulative life table five-year survival, plus
22 and minus two standard errors of deviation, demonstrated a
23 95% cumulative result, with the totally edentulous patient
24 at 96%, and the partially edentulous patient also at 96%.

1 This was based on a 95% confidence factor, and no patients
2 were worse off after failure than before implant treatment.
3 At the present time I am following over 1,950 IMZ implants
4 with similar results.
5 These data correlate with Kirsch's results in 5,230
6 implants, placed between September '78 and December '90. He
7 reported 124 removals, and lost-to-follow-up, 11.1%. His
8 cumulative five-year life table analysis, all implants at
9 five years or greater, was 1,611, demonstrate a result of
10 97.3% in the maxilla, and 97.6% in the mandible.

11 Additionally, while I chaired the Special
12 Committee on Implants for the American Association of Oral
13 and Maxillofacial Surgeons, a survey of the membership was
14 designed. It was carried out by Garfield and Lynn, and
15 analyzed by Richard M. Dube Associates.

16 This survey had a 75% response, with 2,608
17 questionnaires returned. Eighty-nine percent of those
18 individuals were placing implants, and 38% of them had six
19 years experience or longer. The survey also stated that
20 multiple endosseous implants were used by 95% of these
21 individuals. Further, 250,000 implants were placed by these
22 members in this survey.

23 In 1989, all of the training programs in oral and
24 maxillofacial surgery were mandated to include implant

1 training. Subsequently, so have the periodontal training
2 programs.

3 Conclusions and recommendations: After
4 considering my 29-plus years of experience and activity in
5 implant reconstruction, as well as consultation with
6 numerous well-experienced clinicians, not only in the United
7 States but internationally, I strongly urge the Panel to
8 recommend class II status for all endosteal osseointegrated
9 implants, blades, cylinders and threaded.

10 This strong recommendation is based on the wide
11 acceptance, use, favorable benefit-risk ratio, and
12 substantiation with life table analysis. A reference source
13 of 15 clinical studies is included at the end of this paper,
14 in addition to those I have cited in this paper already.

15 The high frequency of use of numerous systems by
16 oral and maxillofacial surgeons, periodontists,
17 prosthodontists, and the implant community overall is a
18 strong indicator of professional acceptance.

19 If there is a divergence in the reclassification
20 of these systems, we are putting at risk a tremendous number
21 of practitioners and, more importantly, a tremendous number
22 of patients who will not be able to undergo these
23 reconstructive procedures, as threaded implants cannot and
24 will not produce acceptable levels of success in some

1 patients. Jaffin and Berman, in their article on "Type 4
2 Bone quality," in the Journal of Periontology, in 1991,
3 demonstrated the unacceptable results with threaded implants
4 used in the posterior maxilla.

5 It is estimated that fully one-half of the
6 edentulous population, which is estimated at roughly 35-40
7 million edentulous persons, cannot function with
8 conventional removable prosthetic appliances. Therefore,
9 these procedures would not be available to improve life
10 quality, eliminate painful thresholds to exposed
11 neurovascular structures, and superiorly positioned muscle
12 insertions. In addition, those cases with severe advanced
13 atrophy, which then create a special group of dysfunctional
14 or end point dental crippled patients would be helpless.

15 It is the purpose of the FDA, the dental
16 profession, and the commercial industrial entities to
17 protect the public. However, it is our responsibility to
18 also demonstrate proven efficacy and sufficient benefit-risk
19 ratios so that these procedures can be continually used when
20 other routine dental procedures are not acceptable forms of
21 treatment as recommended by both NIH Implant Consensus
22 Conferences in 1978 and 1988.

23 I am not being reimbursed by anyone for today's
24 appearance, except for my travel expenses by DIMA. I have

1 in the past received financial support and fees for
2 speaking, lecturing, research, and consultation associated
3 with various commercial companies.

4 Ladies and gentlemen, thank you very much for the
5 opportunity to present this material to you.

6 DR. GENCO: Thank you, Dr. Babbush. Questions or
7 comments for Dr. Babbush? Yes?

8 DR. PATTERS: Dr. Babbush, you seem to be quite
9 confident regarding the available data for safety and
10 efficacy of root form implants. Are you equally confident
11 about blade form?

12 DR. BABBUSH: Yes. I have a long history
13 associated with blade type of implants and, certainly, I
14 group those together in my opinion with the cylinders and
15 the threaded implants, and find that there are sufficient
16 number of cases where the ridge width would be indicative of
17 that form of implant rather than cylinders or threaded,
18 where perhaps you would have to carry out more extensive
19 surgical procedures to achieve placement and augmentation
20 with grafting materials and/or membranes to accomplish the
21 same goal.

22 DR. GENCO: Further comments or questions? Dr.
23 Heffez?

24 DR. HEFFEZ: Have you seen this categorization or

1 implants, the table?

2 DR. BABBUSH: Yes, sir.

3 DR. HEFFEZ: You see implants with special
4 retention features --

5 DR. BABBUSH: Yes, sir.

6 DR. HEFFEZ: What type of implants would fall in
7 that type of category, in your mind? I believe the ones we
8 are talking about are the ones that are designed to have
9 special expansion components once they are in position. I
10 can't remember the name right off the top of my head but
11 there is a root form where, once it is in position, it has a
12 mechanism for expanding the apical end to give better
13 retention, and also there is a blade type which has a
14 flexible type of component. So, I would take it that that
15 category that I see on the sheet would fall to those two
16 implants. Do you have any experience with those?

17 DR. BABBUSH: No, I do not.

18 DR. GENCO: If there are no further comments or
19 questions, thank you very much, Dr. Babbush. The next
20 presentation is by Dr. Freimut Vizathum, from Friatec.

21 **Presentation by Dr. Bill Knox**

22 DR. KNOX: Good morning, ladies and gentlemen. My
23 name is Bill Knox. I am with Friatec, U.S.A., and I am
24 going to introduce Dr. Vizathum in just a moment.

1 (Slides)

2 We thought, if it is okay with the Panel, we would
3 speak briefly about Friatec U.S.A. Friatec is a very large
4 company in Europe but is probably the most recent entry into
5 the U.S. dental implant market.

6 This is Friatec, based in Mannheim, Germany, this
7 entire complex. I assure you we don't just make dental
8 implants with this entire structure here. Friatec is
9 involved in ceramics, pumps and pipes and also dental
10 implants. Friatec has been involved with dental implants
11 since 1976, and we have recently opened our corporate office
12 in the United States, in Irvine, California.

13 (Slide)

14 As I mentioned, Friatec is a large German company.
15 They are currently the European leader in dental implants,
16 not known here, in the United States but, hopefully, that
17 will change. In the past ten years Friatec has trained
18 approximately 50,000 dentists with respect to dental
19 implants in Europe and, since entering the United States
20 market approximately one and a half years ago, we have
21 trained approximately 3,000 dentists here, in this country.

22 I am going to introduce Dr. Vizathum now, who is
23 the general manager of Friatec, Germany. Dr. Vizathum holds
24 advanced degrees in both material science and, obviously,

1 dentistry. He is a clinician with vast experience in both
2 clinical dentistry and also in material science. He is also
3 the co-developer of the Frialit-2 system and currently holds
4 15 U.S. patents on dental implants and has published several
5 clinical articles with respect to implants. Dr. Vizathum?

6 **Presentation by Dr. Freimut Vizathum**

7 (Slides)

8 DR. VIZATHUM: Dear Panel members, ladies and
9 gentlemen, when we talk about dental implants we have to
10 start with the time of extraction. So, after extracting a
11 tooth, we are debalancing the stomatognathic system. As you
12 can see on the left side, this cross-cut of the bone is not
13 a structure which has been growing by chance, it is the
14 trajectorial structure of spongy bone which has to transfer
15 the load from the occlusal plane -- could we dim the lights
16 a little more? So after extracting the root like that, it
17 is not just the lost crown, it is the possible instability
18 of the proximal contact. It is the instability of the
19 antagonistic contact. Last but not least, it is the
20 instability of occlusion which will be a result with
21 influence even on the TMJ.

22 (Slides)

23 If we go on with that situation, this is in many
24 cases the endpoint of treatment after extracting teeth. The

1 atrophy is an ongoing process which is a cascade of
2 pathology, starting with the extraction of teeth.
3 Fortunately, enough dental implants have a chance to break
4 this cascade of pathology, and that is documented in the
5 literature.

6 (Slides)

7 So, if we go on the features for dental implants
8 which may be important for reclassification, we can focus on
9 the implant materials, implant surface, implant designs. on
10 the surgery concepts which have been mentioned as
11 indications and, last but not least, also on the type of
12 load transfer.

13 Regarding the materials, there is consent in the
14 literature in the world that dental implants out of titanium
15 are the most used dental implants, but I would like to make
16 the statement that even other materials may be of benefit in
17 the future, other than the titanium group, say, tantalum and
18 niobium, which are materials which show the same properties.
19 They show a high resistance against corrosion on the one
20 side, and they show a stable passivation layer on the other
21 side. Their use is documented in biomaterial studies very
22 well.

23 Another application of materials of the ceramic
24 implants is the ceramic aluminum oxide implants. These

1 implants are not used widely nowadays, but from the future
2 point of view, their use has been documented in the past as
3 well.

4 (Slides)

5 Dental implants have to support the anatomy. They
6 have a relation to anatomy. So, if you look at that picture
7 you can see that the roots have a strong interconnection
8 with the bone. So, the roots support the bone; the bone
9 supports the soft tissue. We have just had a presentation
10 on the success of the root-shape implant. This implant more
11 or less refers to anatomy from this point of view. If we
12 talk about the features which are important for that, we
13 have to see that if we consider the biomechanical
14 relationship of that design, then we see that, for example,
15 increasing the diameter from 3.8 to 6.5 of a root-shaped
16 implant at the crestal-bone level the stress level at the
17 same occlusion force is relatively declining on a factor of
18 nearly 60%.

19 So, if we discuss sizes which are relevant for
20 dental implants, we have to consider two things: There has
21 to be enough dental implant to withstand the force and
22 enough bone to keep the force. But, on the other hand, the
23 bone is not just mechanically loaded, it is a dynamic
24 process. It is not a material which is dead; it is a

1 material which is able to react.

2 On this graph you can see that the load
3 transferring surfaces here are quite important in limiting
4 the amount of load transfer at the crestal-bone level. So
5 the more the diameter of the implant at the crestal-bone
6 level, the smaller the bone strength which is transferred to
7 the implant itself.

8 (Slides)

9 Referring to the surface characteristics of dental
10 implants, this picture shows you the surface characteristics
11 of machine implants. It is multiplied by thousands. You
12 can see this microroughness at the surface.

13 (Slide)

14 If we continue with grid-blasted implants, even
15 multiplied by a thousand, you can see that there is
16 increased microroughness. The roughness has an RA value of
17 roughly 5 microns compared to the machined implants which
18 have an RA value which characterizes the roughness of 1
19 micron.

20 (Slides)

21 If we continue with the so-called plasma-coated
22 implant, these implants are in an additive process, putting
23 titanium on top of the titanium implant with the plasma-
24 coating flame.

1 (Slides)

2 You can see that this is a surface which shows a
3 surface morphology which is very similar to the surface
4 morphology of the grid-blasted implant. The surface
5 morphology shows RA values, an average roughness value of
6 about 607 microns.

7 (Slides)

8 Chemically, these implant surfaces are equivalent.
9 So there is an ASTM available for titanium, but there is
10 also an ASTM available for titanium powder. What is
11 missing, the gap in between, is the procedure. So, if we
12 have a titanium plasma unit we have to have control
13 parameters, a set of control parameters, and validation of
14 the process. As a result, there is a predictable adhesion
15 of the titanium powder to the titanium surface.

16 (Slides)

17 The biological value of these surfaces are well
18 documented in the literature. You can see that there is
19 direct contact between the bone and the titanium itself.
20 The vessels are even growing directly to the surface of the
21 implant itself, giving a situation which shows the turnover
22 at the bone which allows the adaptation of the bone to the
23 load situation. This remodeling process is the key process
24 for indicating all types of implants because this process is

1 driven by the prosthetic design on the one side, but also
2 the design of the implant and the surface type of implant.

3 (Slides)

4 The prosthetic procedure, as we have already
5 heard, is a key procedure for the success rate when we
6 consider the implant length as one parameter; the implant
7 diameter as another parameter, both adapted to anatomy. We
8 have to consider the distance between the occlusal plane and
9 the crestal-bone level on the other side. Dental implants
10 give a chance, instead of just putting a prosthetic device
11 for the replacement of teeth, to directly load the bone to
12 keep up the direct load into the bone. That means that
13 there is a stable remodeling around the bone and this
14 prevents bone atrophy.

15 I would like to make a statement at this point and
16 ask the Panel for reclassification of the dental implants,
17 root-form dental implants because these implants have been
18 proved and well-documented in the literature. There is a
19 high benefit of treatment of patients with that implant.
20 Thank you very much.

21 DR. GENCO: Thank you. Are there any comments or
22 questions from the Panel? Yes, Dr. Heffez?

23 DR. HEFFEZ: Do you find any benefit from
24 increasing the width of the implant at the apex? Besides

1 increasing total surface area available for
2 osseointegration, the question is, is that significant?

3 DR. VIZATHUM: This is a very important question
4 which is discussed in the literature. If we overlook the
5 biomechanical situation, we have already been discussing the
6 horizontal bending moment of implant abutment connections.
7 If we look to the loading of the bone, we have quite a
8 different situation because our linear mechanics are not
9 well describing what is happening in the bone. If you
10 assume a cantilever coming out of the wall, we are able to
11 calculate the moment which is acting on that cantilever. It
12 is the force multiplied by the length of the cantilever.
13 But it is very difficult. You have to calculate what is
14 acting on the cantilever which is in the wall, and no one is
15 able to calculate what is happening with the load in the
16 wall, and the wall refers to the bone. So, when I showed
17 the graph which shows the decline in load transfer with
18 increasing diameter at the crest-bone level, this decline is
19 referring to what happens at the wall, which means at the
20 bone. An increase diameter is declining the load transfer.
21 At the apical part, this would not be to increase load
22 transfer because the crestal-bone level is the area where
23 bone atrophy and where bone resorption takes place. As in
24 natural teeth, the load has to be transferred to the spongy

1 bone around the implant and not to the crestal-bone level.

2 Is that answering the question?

3 DR. HEFFEZ: Basically, there is no answer to the
4 question I think because we don't know. We are assuming
5 100% osseointegration of the implant in doing those
6 biomechanical studies. We don't know the quality of the
7 osseointegration or we don't know the distribution of the
8 osseointegration around the implant, which I think are
9 important factors in determining the force that is applied.

10 DR. VIZATHUM: Yes, but it is a self-adapting
11 system. The point is that the bone has the potential
12 possibility to adapt to its actual load situation. The
13 example we could follow is the natural root. If we analyze,
14 and we have again seen today, the forces changing from the
15 occlusal biting force, increasing from anterior to
16 posterior, about a factor of 10. So, about a 10-fold force
17 in posterior areas. If we look at how anatomy is balancing
18 these forces, if you look at x-rays, you will see, for
19 example, that it is not the length of the natural roots are
20 increasing but it is the diameter which is increasing from
21 anterior to posterior. The surface area of the root is only
22 driven by the diameter. So the driving force for
23 rebalancing the system in the natural oral cavity is the
24 diameter of the tooth, and we can assume that this is

1 similar for dental implants as well.

2 DR. GENCO: Further questions or comments?

3 (No response)

4 Thank you very much. The next presentation will
5 be given by Dr. Gerald Marlin, from Universal Implants, Inc.
6 Dr. Marlin?

7 **Presentation by Dr. Gerald Marlin**

8 DR. MARLIN: Good morning. My name is Gerald
9 Marlin. I am a prosthodontist, practicing here in
10 Washington, D.C. I am also the President of Universal
11 Implant Systems. I am the design developer of the product
12 line the Octahex Implant Restoration System, which is an
13 abutment system that will interface with any and all
14 implants.

15 The purpose of my taking time today is to request
16 that the Dental Products Panel explicitly address the
17 regulatory options for implant abutments, in order to assist
18 the FDA in arriving at an appropriate degree of regulation.
19 I would also like to present this issue to you from two
20 aspects, as a manufacturer and as a clinician, and perhaps
21 present both viewpoints so that we can kind of interface
22 them a little bit.

23 The problem is that dental implant abutments are
24 over-regulated, with far-reaching effects on the profession,

1 the industry and, more importantly, the public. The scope
2 of what I would like to say to you today is that we have
3 problems with the current regulatory classification of
4 abutments to a degree. We have their potential
5 ramifications of such regulations, i.e., in a financial part
6 to the industry and to the public; and we have the clinical
7 industry experience which justifies reclassification, and I
8 would like to discuss those in a little bit more detail.

9 Abutments are unclassified pre-amendment devices
10 as they exist now. They are labeled as accessories to
11 implants. Therefore, our universal abutment, as an example,
12 would be considered for purposes of example as an accessory
13 to any class III implant. Even though abutments have been
14 shown clinically to be safe and effective, they would have
15 to undergo clinical testing for all these class III
16 implants. Unless implants are reclassified to class II, as
17 an example, our company would be required to do an
18 inordinate amount of clinical testing of our abutment with
19 each class III implant.

20 The effects of the over-regulation are the
21 following: To the best of my knowledge, PMA studies being
22 done to date do not actually capture enough information
23 about each and every abutment used on each and every implant
24 since they are oriented towards implant evaluation, not

1 towards abutment evaluation. Therefore, a whole new set of
2 PMAs could be required for these abutments as well.

3 A new set of PMAs being required would place
4 unnecessary financial burdens on all the companies. It
5 would decrease competition. It would very much stifle
6 innovation and enhancements of new abutments. It would
7 greatly increase the cost to the consumer and would,
8 therefore, draw off necessary funds that would go to more
9 important areas, such as education and training programs for
10 restorative dentists for dealing with implants in the
11 clinical environment.

12 Abutments, therefore, need an appropriate degree
13 of regulation considering their demonstrated safety and
14 effectiveness. Safety and effectiveness can be
15 demonstrated, and it is a reason for reclassification that
16 over the last 14 years of clinical experience that we have
17 in the dental implant industry, both clinically and as
18 manufacturers, and according to Medical Data International,
19 between 1987 and 1997, through 1997, we have over three
20 million implants that have been placed and restored with
21 abutments with, quote, success rates consistently above 90%
22 to 95%, as discussed by Dr. Babbush, in the hands of every
23 clinician, every average clinician.

24 Secondly, the market is self-correcting in that

1 lower quality products would not be repurchased. Third,
2 abutments are comparable clinically to post and cores
3 abutments of endodontically treated teeth. Both of them
4 support a crown or prosthesis. Both have a long clinical
5 history of safe and effective use. Both are stand-alone
6 devices from a clinical standpoint.

7 There are precedents for reclassifying
8 accessories. Clinical and industry experience provide ample
9 support for reclassification of abutments.

10 Let me now change my hat and take the part of the
11 clinician. I have restored 720 implants since 1985. I have
12 only had 3 broken abutments during that period of time, all
13 of which were manufactured before 1987 by others. The
14 correction for those 3 broken abutments was very simple --
15 remove them, rework the prosthesis, with no effect
16 whatsoever on the underlying implant. I have not lost an
17 implant due to a defective abutment. The clinical process,
18 not abutment design or defects, cause difficulties with
19 restoring implants. Yes, implants are difficult to restore.
20 They are very exacting. Those are clinical, clinician
21 viewpoints that have to be taken into account in each and
22 every case that is treated. It is not, again, a design or a
23 defect problem.

24 Screw loosening is rare in my practice.

1 Correction has been merely to remove the prosthesis,
2 retighten the screw and reseal the prosthesis. Infrequently
3 have I encountered a need to rework a framework that has
4 been restored in the patient and been in their mouth for
5 several months or years, and I have not had one that could
6 not be corrected. The correction, again, was relatively
7 simple -- section the prosthesis, resolder it, reseal it.

8 In summary of that, out of 720 implants, I have
9 never lost an implant due to an abutment failure. I have
10 rarely even experienced a broken abutment, as I have stated.
11 I have not encountered a defective abutment design. Quite
12 simply, there is not a safety issue here from this
13 operator's experience.

14 Now let's talk about the industry experience.
15 Abutments have a long history of minimal clinical problems
16 caused by device design or manufacture. Our experience at
17 Universal Implant Systems is that the abutment is consistent
18 with this history of minimal clinical problems. NDRs show
19 that most of those problems that were listed were due to
20 clinical error and not design. Materials used in abutments
21 have been used safely and effectively over the last 14
22 years. The rigorous bench testing of abutments apply
23 stresses much greater than those generated in the clinical
24 environment. As an example, our abutment is tested through

1 150 lbs. without any breakage, and we had Dr. Balfour tell
2 us that the average clinical levels are anywhere from 9-93
3 lbs.

4 I propose to you the following, that dental
5 implant abutments be expeditiously classified as separate
6 devices to class I or class II, or be left alone as pre-
7 amendment devices. Perhaps consideration should also be
8 given to the applicability of a class I exempt category for
9 these products on the basis of the extensive and positive
10 clinical experience encountered over the last 14 years with
11 greater than 3 million implants.

12 In conclusion, as a clinician and a manufacturer,
13 my bottom line is patient safety. It always has been. And,
14 from my own experience, personally, in my discussions with
15 over 3,000 dentists in courses that I have given to them on
16 restoring dental implants, and in a review of the
17 literature, I am extremely confident that abutments should
18 be reclassified to class I or II, without compromising
19 patient safety.

20 We hope that this issue will be addressed by the
21 Panel and the FDA as soon as possible. I thank you and I
22 appreciate the opportunity to present before you.

23 DR. GENCO: Thank you very much, Dr. Marlin. Any
24 comments or questions from the Panel?

1 DR. REKOW: I have a question. Has there ever
2 been a case where an abutment has caused an implant to fail?

3 DR. MARLIN: There are cases where, certainly, an
4 abutment has caused an implant to fail, but they are so rare
5 that I have barely seen it. It would basically boil down
6 to, if the abutment would cause the implant to fail, it is
7 not the abutment itself, it is did the practitioner seat it
8 all the way? Did the practitioner assemble the framework
9 correctly? That would basically be the biggest issue. More
10 often than not, the abutment would fracture or the screw
11 would fracture. Certainly, there could be situations where
12 an implant would fail but, again, that is extremely low.

13 DR. REKOW: Thank you.

14 DR. GENCO: Further comments, questions from the
15 Panel? If not, thank you very much, Dr. Marlin.

16 DR. MARLIN: Thank you.

17 DR. GENCO: The next presentation is by Dr. Victor
18 Sendax, from MDIC Management, Inc. Dr. Sendax?

19 **Presentation by Dr. Victor Sendax**

20 DR. SENDAX: Good morning. I am here to review or
21 to present, I suppose, a somewhat different approach to
22 dental implants than what has hereto before been considered
23 standard practice. The implant system, the mini-type of
24 dental implant, which is essentially a very small implant

1 that is designed to be transitional in nature, falls into
2 the category on your grid basically as a one-stage with
3 immediate loading implant. It is more or less in the
4 category at the bottom of page two, where the implants are
5 used for a limited period of time, transitional or temporary
6 in nature.

7 To give a little overview on this whole concept,
8 mini-dental implants have an ultra small diameter, 1.8 mm
9 width, implants. We generally do not think, in terms of
10 implants, having that width, needless to say. They are
11 biocompatible, titanium alloy implant screws. They were
12 conceived and designed over some 22 years ago by me as
13 transitional devices to help support fixed bridge
14 replacements for lost teeth. Mini-implants can function
15 free-standing by themselves or in combination with natural
16 tooth supports and/or the conventional types of implants.

17 When critically needed for support purposes and
18 where solid bony integration or adaptation has clearly
19 occurred, mini-implants can conceivably function as longer-
20 term supporting structures rather than short-term or medium-
21 term devices. In my own practice, on a limited clinical
22 trial basis, they have been successfully functioning in
23 patients' jaws for several decades.

24 It must be recognized, what by now is obvious to

1 all of us, that all implant systems as well as natural teeth
2 are subject to potential failure due to natural causes,
3 including osteoporosis, poor oral hygiene, wear and tear,
4 attrition, poor health, heavy stressful biting habits and a
5 lack of follow-up maintenance care.

6 Mini-implants, similarly, do not carry any actual
7 or implied longevity guarantees or even implications.
8 However, the loss of a mini-implant is a far less critical
9 event since it may be replaced at relatively minimal cost
10 and minimal surgical application compared to conventional
11 implants, and with minimal associated bone or soft tissue
12 deterioration.

13 As a rather unique departure from routine implant
14 methodologies, mini-implants are so slender at 1.8 mm in
15 width that they are typically inserted -- and this is
16 perhaps a little controversial -- directly through the
17 overlying soft tissue into the bone underneath.

18 Consequently, the need to surgically incise and flap open
19 the soft tissue, routinely required for standard implant
20 systems, is avoided in most applications, though not
21 mandatory, and it is avoided in most applications for these
22 transitional mini-implants, thereby, significantly reducing
23 the post-insertion irritation and postoperative morbidities
24 that are seen. While they are not extensive, they are

1 annoying to patients, and to be able to eliminate that is
2 important.

3 What is even more important is the fact that every
4 time we incise tissue, flap it and do a fairly aggressive
5 surgical procedure there is, unfortunately, the issue that
6 goes along with it, known generally as remodeling or die-
7 back, or it comes under a lot of different headings but
8 basically you lose bone, crestal bone and sometimes some of
9 the peripheral cortical plate of bone as well. This is
10 eliminated in this particular application because no
11 flapping and no surgical approach is required, and the
12 osteotomy that is used to initiate this whole process, as I
13 mentioned, is directly through soft tissue into the
14 underlying bone and it is absolutely minimal. It is just a
15 starting osteotomy, just to make a start for a self-tapping,
16 very narrow screw.

17 While all implants require care during insertion
18 to avoid encroachment on vulnerable nerve, sinus or bony
19 structures, the ultra small width of the mini-implant
20 provides a more comfortable margin of safety than a wider
21 implant, requiring only a single surgery for insertion and
22 then put into immediate biting function, thanks to its self-
23 tapping design. We can, thereby, anchor a transitional
24 fixed bridge system often in a single -- in other words, the

1 entire implant service, surgical and prosthodontic, the
2 transitional service can be applied in a single office
3 visit.

4 The most typical way in which this device is
5 currently being used is to provide some support while
6 conventional implants are integrating, particularly in the
7 systems where there is a two-stage system. It also has
8 application even in a one-stage system because while we are
9 anxious, in a one-stage system, to avoid the two-stage
10 issues we sometimes have to deal -- in fact, we often have
11 to deal with the iatrogenic issues of transitional
12 appliances that can weigh heavily on the tissues and on the
13 implants themselves during the healing phase. It becomes a
14 very serious issue in terms of potential loss of implants,
15 conventional implants or otherwise.

16 So, I think there is an important niche that these
17 implants fill in the overall analysis of where implants are
18 today because they are transitional devices and because they
19 are looked upon as essentially transitional devices. We
20 would like to see these, of course, as well as other
21 endosteal implant systems classified as class II devices.
22 We feel they are benign devices, as we do really all implant
23 systems currently available today.

24 We know there are learning curves. We know there

1 are all kinds of problems with any system that you apply in
2 the mouth, any system in the hostile environment of the oral
3 cavity is bound to be subject to a lot of potential problems
4 and concerns. But I think what we have to be concerned with
5 primarily in all of our considerations, both on your side of
6 the Panel and on mine, is are these devices doing what they
7 are supposed to do for the public at large in a responsible
8 and effective way? I think the data over the years supports
9 that.

10 Speaking of data, I would like to spend a few
11 minutes just reviewing our comparative data summary, which
12 was included in the submission -- I don't want to go into a
13 lot of detail now, obviously, there isn't any time, but I
14 just wanted to review in very broad brush strokes what our
15 history has been. Originally these implants really started
16 as titanium screw posts that were manufactured by the
17 Swedish company Dentatus many years ago. They go back a
18 long way to the time when titanium was first being
19 introduced in dental devices, typically in endodontic posts.

20 We started using these to give us some sort of
21 transitional device, in the manner I have just described.
22 The total number of patients with commercially pure titanium
23 Dentatus post devices, which were the original devices not
24 with my modifications in recent times, but from May 1976 to

1 July 1996, over a 20-year span, 216 patients were treated.
2 As to the total number of implants at risk with CP titanium
3 Dentatus devices utilizing my own insertion or
4 reconstructive protocol which, again, went from May 1976 to
5 July of 1996, 406 implants were at risk during that time
6 span.

7 As to the morbidity profiles of these devices, the
8 CP titanium Dentatus post devices utilizing my insertion and
9 reconstructive protocol from May '76 to July '96, of that
10 aggregate total that we just described, fractured and
11 removed were 27; mobile and removed, in other words just
12 loose and came out, were 18. The total failures were 45,
13 and that was basically an approximate 11% failure.

14 When we move to the short-term applications of my
15 own devices, which have certain modifications, most
16 importantly, I feel, the shift from a CP titanium for a very
17 narrow 1.8 mm device, we decided when we were going to try
18 to seriously approach this field that we were going to
19 convert the CP titanium to the much respected titanium
20 alloy, a biocompatible material, and we have run comparative
21 tests that were done at the University of Alabama, which I
22 think were pretty decisive in showing more than double --
23 very rough terminology here but more than double the
24 yielding load, in other words the yielding load and the

1 yield strength and the ultimate load strength of the minis
2 done with the alloy over the CP titanium was very, very
3 evident. So, we were able to show in an interesting way I
4 think that the alloy, certainly for this kind of unique
5 width, 1,8 mm width, was very effectively managed.

6 The figures we have are as follows: Total number
7 of short-term patients with titanium alloy mini-implants
8 from July '96 to July '97 were 57. These are patients. The
9 total number of short-term implants at risk with the
10 titanium alloy mini-implants utilizing my insertion and
11 reconstructive protocol from July '96 to July '97 totaled
12 169.

13 As to the morbidity profile, titanium alloy Sendax
14 mini-implants utilizing my insertion and reconstructive
15 protocol from July '96 to July '97, fractured and removed,
16 none. Admittedly, that is only over a year's time. But the
17 mobile and removed implants totaled 3. So our total
18 failures came to 2% of the aggregate.

19 As far as a little discussion on this, the
20 mobility or looseness of mini-implants typically occurs in
21 the first few weeks following insertion, and is almost
22 always associated with over-instrumentation of the bone at
23 the time of the essentially simple drilling procedure or
24 osteotomy that is performed. Once the learning curve is

1 mastered for the bone site preparation, subsequent mobility
2 is rarely encountered if self-tapping bone to implant
3 integration is achieved at the outset. Steady-state bone
4 stability is then almost routinely encountered. Fracture is
5 totally minimized when the titanium alloy -- the titanium-6-
6 aluminum-4- vanadium that has been standard for so many
7 years -- is utilized instead of the CP titanium, I think
8 that speaks for itself and those studies were included in
9 the submission. That is University of Alabama that showed
10 the comparative mechanical testing graphs to confirm this
11 essential finding.

12 I would like to just simply summarize what I have
13 presented so far with a request, again, that these devices,
14 which are very benign devices and are currently functioning
15 in a very effective way on a limited basis so far because we
16 are just about to have our 510(k) approval, I hope and
17 presume, and we are waiting really to do any significant
18 general professional distribution of these devices, or
19 marketing of them, or attempts to market them, we are
20 holding off obviously until that is cleared. So I would be
21 happy to answer any questions here.

22 DR. GENCO: Thank you, Dr. Sendax. Any comments
23 or questions from the Panel? Yes?

24 DR. HEFFEZ: I have one question. Can the

1 placement of these mini-implants and their loss due to
2 osseointegration render not possible the placement of the
3 permanent implants, their location and the way they are lost
4 render placement of the final implant?

5 DR. SENDAX: To answer that directly, I have never
6 seen that because the devices, when they are removed, are
7 removed virtually without any loss of any tissues. The soft
8 tissue closes in immediately and the amount of bone loss is
9 minimal. I suppose it is conceivable you could if there
10 were some very severe movement issues involved, you could
11 have some bone loss. But because the device has such a
12 small footprint, I think you are looking at a situation
13 that, at least in my experience and from what I have
14 gathered from several colleagues who have been helping us
15 develop some of the standards for this system, we have not
16 seen that.

17 DR. GENCO: Further comments, questions from the
18 Panel?

19 (No response)

20 Thank you very much, Dr. Sendax.

21 DR. SENDAX: Thank you.

22 DR. GENCO: We will now take a 15-minute break.

23 So, I would request that you come back here at 10:30. Thank
24 you.

1 (Brief recess)

2 DR. GENCO: Pamela Scott has an announcement to
3 make.

4 MS. SCOTT: There is a message for Miss Catherine
5 Cook at our sign-in desk, if you would go to the sign-in
6 desk. Also, if there are any materials that any speakers or
7 anyone from the industry would like to be distributed to the
8 Panel members, if you would see me I can have that done.
9 Thank you.

10 DR. GENCO: Thank you. Our next speaker is Dr.
11 Hessam Nowzari, from Sargon Dental Implants. Dr. Nowzari,
12 please proceed.

13 **Presentation by Dr. Hessam Nowzari**

14 DR. NOWZARI: This is what I have written in my
15 report, clinical cases.

16 (Slides)

17 These are patients who have had several episodes
18 of periodontal abscess with tooth number 9 and tooth number
19 10. Once I raise the flap, you can see the extent of
20 periodontal attachment loss and the presence of heavy
21 calculus. There is a 2 mm diastema, open contact between
22 tooth number 9 and 10.

23 (Slides)

24 After periodontal treatment, I did 10 weeks of

1 forced eruption and 12 weeks of stabilization. The tooth
2 was erupted distal occlusal.

3 (Slides)

4 This is the day of the surgery. I extracted the
5 tooth and osteotomy was done inside the lingual wall of the
6 extraction site. There was no flap raised, and this is the
7 surgical gap.

8 (Slide)

9 This is the palatal view of the implant after
10 placement. After placement, the expansion mechanism of the
11 implant was activated. So apically now, it is expanded with
12 close to 10 newton force.

13 (Slides)

14 The day of the surgery immediately, as you can see
15 on your right side, it was placed. This is the day of the
16 surgery and placement of the provisional and the implant was
17 loaded immediately.

18 (Slides)

19 On the left side is after one week; at your right
20 side is after one month.

21 (Slides)

22 On your left side is after eight months, and this
23 is the final porcelain on your right side.

24 (Slides)

1 This is the radiographic examination of the
2 implant at nine months.

3 (Slides)

4 On your left side is before; on your right side is
5 after.

6 (Slides)

7 Basically, I have been involved with histological,
8 microbiological, and clinical study of this implant system,
9 and I have written in my report what I think about the
10 system. If there are any questions, I would be glad to
11 answer them now.

12 DR. GENCO: Thank you, Dr. Nowzari. Any comments
13 or questions from the Panel? What is the status of this
14 implant? How many years has it been on the market, and what
15 sorts of numbers of implants have been placed, and do you
16 have any idea of the success rates?

17 DR. NOWZARI: At our institution, the success rate
18 has been a hundred percent, at the University of Southern
19 California.

20 DR. HEFFEZ: Could you answer further? How many
21 implants did you place?

22 DR. NOWZARI: I have restored 30 patients. This
23 is part of the prospective study. Prior to that I did a
24 pilot study with 50 patients.

1 DR. GENCO: A total of 80 patients?

2 DR. NOWZARI: Right.

3 DR. GENCO: How many implants?

4 DR. NOWZARI: I would say 150.

5 DR. HEFFEZ: And over what duration of time?

6 DR. NOWZARI: This is my report, but I know that
7 there is a seven-year report with this implant system, and
8 Dr. Lazarof has seven years of results with this implant
9 system.

10 DR. HEFFEZ: The only last question I have is
11 would you feel that this implant would fall in the proposed
12 classification of implants with special retention features?

13 DR. NOWZARI: I am not very familiar with those
14 classifications. I was asked to come here and give my
15 opinion about this system, and my opinion is that, as the
16 chairman of advanced periontology at the University of
17 Southern California, I feel very comfortable to tell you
18 that, to me, this is the state-of-the-art and the best
19 modality which can be offered to patients today. That is
20 what I feel about this implant system.

21 DR. GENCO: Further comments, questions?

22 (No response)

23 Thank you very much, Dr. Nowzari. The next
24 presentation will be by Dr. Charles Weiss, from Oratronics,

1 Inc. While Dr. Weiss is coming to the podium, you all have
2 the program. The next speaker will be Dr. Herrmann and
3 maybe she can get prepared. It takes about 15 minutes for
4 each speaker. Dr. Weiss?

5 **Presentation by Dr. Charles Weiss**

6 DR. WEISS: Members of the Panel, thank you for
7 your time in hearing these comments. Oratronics was founded
8 in 1969. I have been the Chairman of the Board and
9 President for most of that time.

10 Endosseous dental root form implants are currently
11 the most widely utilized system in the United States. It is
12 my belief that they are safe and effective for their
13 intended purpose, and that this committee is justified
14 should it elect to reclassify them. Because of certain
15 prevalent and unfounded perceptions within the root form
16 community regarding blade implants, perceptions promoted
17 mostly by inaccurate root form marketing, for the sake of
18 clarity I have elected to cite data that compare root form
19 and blade form implants.

20 If the committee chooses to reclassify root forms,
21 they should also reclassify blade forms because the
22 presented data is at least equal, and often superior over
23 equivalent periods of time following implant insertion.

24 Regarding blade clinical trials, Dr. Krishan

1 Kapur, who was chosen by the FDA and NIH to lecture on how
2 to properly conduct clinical trials at the 1988 Consensus
3 Development Conference in Washington, was the principal
4 investigator in the VA-sponsored prospective, controlled,
5 longitudinal, independent, randomized clinical trial
6 exclusively utilizing the Oratronics Weiss Osteo-Loc-One-
7 Stage Standard Blade Implant System. As you know from all
8 the material submitted to you, there are precious few
9 studies that are prospective and as beautifully conducted as
10 this study.

11 The success/survival rates were higher and degree
12 of bone loss lower than that reported in the Adell, Lekholm,
13 Rockler, Branemart serial study and the Cox, Zarb et al.
14 Toronto replica study conducted on the Branemart root-form
15 implants. The fifth amendment to DIMA's petition to
16 reclassify dental implants exhaustively analyzes and
17 compares the primary studies supporting the blade and root-
18 form systems, and this study is in your possession now, and
19 provides thorough references from peer-reviewed published
20 articles with direct quotes including pages and line
21 numbers.

22 The survival/ success rates of blade implants were
23 at least equal and often superior to those of the root
24 forms. Of particular importance is the fact that both blade

1 and root forms, over a 5-year period, were found to result
2 in less than half of the bone loss, or bone deterioration,
3 reported over equal time periods for unimplanted edentulous
4 alveolar ridges of the types utilized in these studies.
5 Thus, the utilization of either root or blade form
6 endosseous implants materially reduces the rate of
7 resorption of edentulous alveolar ridges. For a comparison
8 of the clinical trials conducted on the Weiss implants and
9 Branemart fixtures, please see the fifth amendment of the
10 DIMA petition that you have.

11 There has been full acceptance granted by the
12 American Dental Association of the Oratronics Weiss Osteo-
13 Loc One-Stage Standard Blade Implant System. The clinical
14 trials submitted for this system were the Kapur trials
15 previously referred to, and an NIH-sponsored replica trial
16 at Harvard University. The Weiss One-Stage Blade System is
17 the only system that has been fully accepted by the American
18 Dental Association for use with natural co-abutments for
19 support of a fixed bridge.

20 Recently, the ADA changed the criteria for
21 granting full acceptance. Currently, 70% of the implants in
22 any clinical trials submitted to the ADA must be placed in
23 the posterior segments of the dental arches. Systems
24 already granted full acceptance have been grandfathered. To

1 our knowledge, the Oratronics Weiss Osteo-Loc One-Stage
2 Blade System is the only grandfathered system that meets the
3 revised criteria for full acceptance. A sufficient
4 percentage of blade implants utilized in these clinical
5 trials submitted for full acceptance were placed in the
6 posterior arch segments.

7 Note that the occlusal forces applied to implant
8 abutments in this area are four times greater than in the
9 anterior segment, where most of the studies were done.

10 Note also that the blade implants utilized in the
11 edentulous posterior segments in the Weiss System studies
12 were inserted into narrower and shallower available bone
13 than that utilized in the anterior segment in the root-form
14 studies.

15 Note also that throughout the Weiss Blade System
16 study, not one natural co-abutment under an implant-
17 supported fixed bridge was lost. Not one. In the study
18 controls, cases of posterior edentulism were restored with
19 removable partial dentures retained by clasping to splinted
20 pre-molars. Many natural teeth used for retention through
21 partial denture clasping were lost. Thus, blade implant-
22 supported fixed bridges with natural co-abutments are
23 preventative dentistry in that they help to eliminate the
24 serial loss of natural teeth so often associated with

1 removal partial dentures.

2 There has been vast usage of blade implants over a
3 period of thirty years. Approximately 1.5 million blades
4 have been utilized as abutments for restorative dentistry
5 worldwide over these thirty years, long-term usage that has
6 demonstrated that blade implants are remarkably free of
7 long-term deleterious effects, and that they are
8 particularly technique-permissive. In addition, they have
9 been proven to be suitable for long-term use as abutments in
10 cases of posterior edentulism, as I said, in conjunction
11 with natural co-abutments.

12 There has been an absence of clinical trials or
13 published scientific articles showing that blades are less
14 safe or effective than root forms in any way. Not one
15 published article in Medline or in other computer literature
16 search vehicles states that blade implants have lower
17 success or survival rates as compared with root forms. In
18 fact, looking back 22 years in Medline, there were only four
19 articles that could be found under adverse effects for
20 blades; and looking back for 12 years, with root forms there
21 were in excess of 40 such articles.

22 The position of the American Academy of Implant
23 Dentistry on blade implants and other systems is also of
24 importance for you to know. The American Academy of Implant

1 Dentistry is the oldest dental implant society in the United
2 States and perhaps in the world, and the sponsor of the
3 American Board of Oral Implantology and Implant Dentistry,
4 which has been recognized by 50 states of the Union today,
5 adopted a position paper in September, 1997, that states
6 that nine implant modalities are safe and effective for
7 their intended purpose of providing stable, functional
8 abutments for restorative dentistry, and that proficiency
9 with all of these modalities, rather than only one of them,
10 materially increases the scope of treatment that
11 practitioners can offer their edentulous patients. Blade
12 implants are one of the accepted modalities. You have a
13 copy of this position paper for your reference.

14 Oratronics has a solid record of blade implants
15 regarding safety, efficacy and quality. For instance
16 litigation, since it was founded in 1969, Oratronics has
17 never lost or even settled a single lawsuit related to blade
18 implants or any of its other products, something we are very
19 proud of. With in excess of one million implants sold by
20 Oratronics over this time, this stands as a testament to the
21 safety and efficacy of the blade implant.

22 FDA reporting: Microfiches obtained under the
23 Freedom of Information Act showing reports to the FDA by
24 dental implant manufacturers of breakage and failure

1 demonstrate that for each 1,000 implants sold, there are 25-
2 50 times more records of trouble with root forms than blade
3 forms.

4 Extensive suitability for patient use: Blade
5 implants are suitable for use in 100% of the patients with
6 available bone suitable for root forms, and are suitable for
7 use in 90% of the remaining available bone not suitable for
8 root forms. Note that in these cases there is no need for
9 augmentation or nerve repositioning procedures in order to
10 accommodate the patient.

11 Example of a persistent misconception regarding
12 blade implants: One persistent misconception about the
13 blade implant is that due to the utilization of a high-speed
14 drill to prepare the osteotomy or receptor site for the
15 implant, the bone is burned and, thereby, damaged, leading
16 to compromised success/survival rates. However, no
17 previously published article investigated this matter in a
18 scientifically meaningful way. In the September-October
19 issue of The International Journal of Prosthodontics,
20 published by Quintessence, the editor of which is the
21 present president of the Academy of Osseointegration, part
22 one of a two-part article authored by Iyer, Weiss -- myself
23 -- and Meta demonstrates that heat production resulting from
24 high-speed drilling of osteotomies for blade implants is

1 significantly lower than heat production resulting from
2 intermediate or low-speed drilling. In fact, due to the use
3 of water coolant, the temperature during osteotomy
4 preparation is actually lower than body temperature. Part
5 two of the article, which will appear in the November-
6 December issue of the International Journal of
7 Prosthodontics, demonstrates the amazing thing, that the
8 healing of the osteotomy as prepared during high speed at
9 lower than body temperature is faster and quantitatively
10 superior to healing after preparation of osteotomies using
11 intermediate or low-speed drilling, which result in a higher
12 temperature production. Thus, the concept that high-speed
13 osteotomy preparation produces excessive heat that burns
14 bone has now been proven to be a myth. Reprints of part one
15 of this article, and copies of the page proofs of part two
16 are in your possession.

17 Interface surface treatment, impressed textures
18 versus applied coatings: Blade implants are most often
19 shaped or bent at the time of insertion to conform to the
20 anatomy of the existing available bone, curvature of the
21 dental arch for instance, to achieve parallelism.
22 Therefore, interface textures that are impressed into the
23 metal, for example, Oratronics Tissue-Tac Interface, are
24 thought to be an interface treatment of choice. Interfaces

1 that are applied, such as plasma spray or the HA-family
2 coatings, have been observed to crack, delaminate or
3 dissolve, leaving non-biocompatible portions of exposed
4 altered substrate in contact with the investing tissues.
5 Impressed interface textures do not experience these
6 complications. At the very least, special labeling
7 requirements for coated implants are in order.

8 Previous submissions, insofar as they apply to
9 blade implants: Voluminous information has been given to
10 you in the past and I recommend it to you.

11 I would like to end by pointing out that blade
12 implants can function either osseointegrated or fibro-
13 osseointegrated. In the osseointegrated configuration they
14 have wonderful use as backup for root forms in the anterior
15 where the doctor or practitioner thought that they could put
16 four or six implants and they could only find enough bone
17 for two or three, they can now add osseointegrated blades
18 and get additional support. Also, they can be used in the
19 posterior where the root forms cannot, without a lot of
20 augmentation or additional surgery. Therefore, we can avoid
21 the deleterious effects of cantilevering that we saw so
22 clearly today.

23 But there has been a breakthrough in blade
24 implantology, and I want to tell you about it. Years ago,

1 if you broke your leg you were put in a cast and hung up in
2 a hospital for four to six weeks with your leg in the air.
3 Today, you break a leg and two days later you are walking
4 around. What is that? You get a walking cast. What is a
5 walking cast? It keeps the broken ends in apposition and
6 immobile and, yet, lets the muscles and tendons act on the
7 bone for whatever bioelectric beneficial that gives you, and
8 you can heal. People say how can you take a blade implant
9 and finish the case in four, five or six weeks time and put
10 the patient into function? It is still healing; how could
11 you do that? The same way we do walking casts. The trick
12 is that you have to sequence your case properly and the
13 final fixed bridge becomes the walking casts and it never
14 needs to be removed. Microcorrosion cast, by Otah in Japan,
15 showed us the sequence of this healing almost day by day,
16 and we know that this works and this, in fact, is what was
17 done in the Kapur study and in the NIH study, where in some
18 area of ten weeks the implants were joined to the final
19 restoration for splinting so that they could continue their
20 healing and the patient put into slowly increasing function.

21 I want to point out also that there is insurance
22 to think about. We have to look at all of the things that
23 we are doing in implantology and make sure that as the
24 insurance industry starts to come into the dental industry

1 more and more that we have cost effective and time effective
2 procedures that can help our patients, and blades rank
3 extremely high among such procedures in every study that has
4 been done, including one just made public by the American
5 Academy of Implant Industry Research Foundation at its
6 September meeting, in Atlanta, Georgia.

7 I put to you that Branemart did not invent the
8 screw type implant. He showed the profession a system of
9 use for this type of implant that would work, and it does
10 work. I did not invent the blade implant and I have devoted
11 my life to seeing that the design of these implants is
12 proper. I believe I have been quite successful and that,
13 and setting up a system that shows how to use them. You
14 cannot mix the systems. You cannot say that what applies to
15 one applies to another. And 95% to 98% of all orthopedic
16 implants are fibro-osseointegrated. The myth that that is a
17 detriment rather than the truth, which is that it is an
18 extreme benefit, has to be dispelled once and for all.

19 I urge that we look at the science that is behind
20 this and behind all of the implants that you have been
21 hearing about today. I firmly support root-form implants
22 for reclassification. I firmly support blade implants for
23 reclassification.

24 I want you to know that for the last 18 years I

1 have taken not one penny out of Oratronics. I wrote off 1.5
2 million dollars in salary that I made during that time and
3 put it into research. I have six children, eleven
4 grandchildren. I am a clinician. I have taken care and
5 raised all of my family through practicing dentistry and I
6 have done many thousands of implants of the types that we
7 are discussing. Thank you very much.

8 DR. GENCO: Thank you, Dr. Weiss. Any comments or
9 questions from the Panel?

10 DR. STEPHENS: I have one.

11 DR. GENCO: Yes?

12 DR. STEPHENS: Do you think that the surgical
13 technique for this procedure is more technique sensitive to
14 the operator than for root-form implants?

15 DR. WEISS: Do I think that the surgical technique
16 for inserting the blade is more or less technique sensitive?

17 DR. STEPHENS: More technique sensitive.

18 DR. WEISS: That reminds me of a fellow that went
19 into a bar, and the bartender said do you want scotch or rye
20 and he said yup. I will tell you why I say that. In
21 certain cases yes, and in certain cases no. In the
22 standard, basic, routine case where you use an implant with
23 a few natural co-abutments for a small fixed bridge rather
24 than a partial, I believe that putting in that implant is

1 simpler than putting in root-forms in that kind of an area.
2 We also have to mention what we are talking about. For root
3 forms you have to take models; you have to make templates;
4 you have to decide where it will be and you can't always put
5 the implant where the best bone is because of prosthodontic
6 considerations, which do not exist for blade implants
7 because of the smaller abutment measurements.

8 So, yes, there are times when putting in a blade
9 implant is more sensitive. There are times when it is less
10 sensitive to do so, on a case by case basis.

11 DR. GENCO: Further comments, questions? Yes,
12 John?

13 DR. BRUNSKI: Dr. Weiss, you mentioned in the
14 literature and history of the blade that they can work with
15 the osseointegrated type of interface, as well as the fibro-
16 osseous type of interface. Do you have any idea, in the
17 studies that you are quoting, what percentage was one type
18 versus another?

19 DR. WEISS: The studies for the two-stage blade
20 implant were conducted by Fritz, I believe, as part of the
21 primate study, in Atlanta, where Prof. Lemmons and others
22 were involved, where they took a Branemart-shaped implant,
23 or an exact copy of it, calculated the exact interface area
24 of the implant and then Oratronics was asked to make a blade

1 implant that had the exact interface area so that variable
2 would be eliminated. The implants were placed, and in every
3 place where they were measuring the osseointegration level,
4 the blade type implant had a higher percentage of
5 osseointegration, and all of that information was published
6 in the AADR abstracts prior to some of the meetings. Are
7 you familiar with that study? I am sure you are.

8 DR. BRUNSKI: Yes, I am. Yes, I guess what I was
9 asking though was in terms of the clinical history of
10 blades. Are you saying that if it is a single-stage kind of
11 a treatment one should assume that it is fibro-
12 osseointegrated?

13 DR. WEISS: Oh, yes. Yes, I think that we have
14 learned how to purposely cause fibro-osseous integration by
15 having some early micro-movement on the implant when we put
16 it into hypofunction, not afunctional, not full functional
17 but hypofunction for the short period of time before the
18 final prosthesis is seated. We think that that is what
19 causes it, that micro-movement, and we want it and we want
20 to control it, and we think we have been able to do that.

21 DR. GENCO: Further comments, questions? If not,
22 thank you very much, Dr. Weiss.

23 DR. WEISS: Thank you all very much.

24 DR. GENCO: The next presentation is by Dr. Irene

1 Herrmann from Nobel Biocare.

2 **Presentation by Dr. Irene Herrmann**

3 DR. HERRMANN: My name is Irene Herrmann, and I
4 represent Nobel Biocare with the Branemart system. I am a
5 dentist. I have been in charge of clinical research at
6 Nobel Biocare for eleven years. I also have a past with the
7 pharmaceutical industry.

8 (Slide)

9 Let me first start with bringing down
10 reclassification of dental implants to three subgroups that
11 we have to consider when we start to discuss results. It is
12 the implant itself, with material, design and surface.
13 Then, of course, it is the patient, the site where you are
14 placing the implant, the prosthesis and the surgical
15 technique. Last but not least, it is the study, the
16 indication you are looking at; the control or success
17 criteria you are using and the statistical evaluation.

18 We did research in Medline and we also used our
19 internal reports if the studies were conducted according to
20 the European standard, EN 540, with the final report. We
21 looked at permanent titanium implants, and divided them in
22 subgroups like machine-surfaced and Branemart which only
23 comes in a screw design, and we also subgrouped the other
24 ones which we could find through the Medline search. We

1 also looked into something called temporary implants, or
2 other implant design or non-titanium implant design, and we
3 subgrouped them as much as we could.

4 We then classified according to the documentation
5 that we could find: one, if they had it for all types of
6 indications, partial if they had it for some types of
7 indication or if they were not available to bring down in
8 subgroups; limited if not all, or if not the majority of the
9 patients were followed for the entire study if we are
10 talking about long term; and missing if we couldn't find
11 anything; and negative if we found the information but it
12 was negative.

13 According to this list, we definitely think we
14 have good documentation on the screw-shaped titanium machine
15 surface Branemart.

16 (Slide)

17 Let's look at the implant. If we talk about
18 material we have to remember that we are talking about
19 biocompatible material. The design that is well-documented
20 is the screw-shaped design. When we talk about surface,
21 what we want to achieve is osseointegration. You can
22 achieve osseointegration, and through the clinical studies
23 you have proof on a long-term basis or on a short-term
24 basis. Of course, you should not rule out implants that

1 only have short-term documentation if they are used for
2 temporary use. But if you want to use them for permanent
3 use, of course, you should demand long-term documentation.

4 (Slide)

5 Then, again, we have to look at the patient. The
6 site where you are placing your implant -- we have difficult
7 sites which have been referred to earlier, where the bone
8 quality is poor; the amount of bone is limited. Then we
9 have the easy sites, which is the anterior mandible, where
10 the first studies were done, where you get high success
11 rates very easily.

12 Then, of course, we have to consider what you are
13 placing on top of the implant. If it is a one-unit
14 prosthesis the demands are not as great as if it is
15 multiple, which people before me have spoken about.

16 Of course, the surgical technique, if we have the
17 two-stage technique, which is the most common technique with
18 the Branemart system, or if we have the one-stage delayed
19 loading or immediate loading, and maybe we should also add
20 the three-stage where we are using grafts as well.

21 (Slide)

22 So, we tried to break this down a little bit, and
23 this is what we did for the Branemart system. First we have
24 the surgical treatment and aspects. If we have short-term

1 documentation on the one-stage procedure, then we can rely
2 on the long-term documentation based on the two-stage
3 procedure if we achieve osseointegration and if we do proper
4 clinical trials so we really compare, and now we are talking
5 about controlled clinical studies. If we then go down to
6 the prosthetic treatment, we have documented, published
7 studies on total edentulism for bridge construction in the
8 maxillae as well as in the mandibles. For all the
9 dentures, both the maxillae and mandibles, we have the new
10 implant which is placed in the zygoma, where it is only for
11 the maxilla for obvious reasons. We have partially
12 edentulous bridge constructions. We have results from
13 posterior maxilla and posterior mandible and, of course, we
14 have single-tooth replacement for the maxillae and
15 mandibles, all showing high success rates.

16 You can also use the implant for orthodontic
17 reasons and temporary implants, which is not so well
18 documented as yet.

19 (Slide)

20 But let's continue and discuss the type of study
21 because I think it is here that we have the proof or we
22 don't have the proof. It is easy to show a 99% success rate
23 if you don't conduct the study according to standards, or if
24 you don't conduct studies according to what the

1 pharmaceutical industry has shown to be effective. So, you
2 have to decide what indication you are looking into. If you
3 include all types of indications and mix difficult and easy
4 indications, you will find it very difficult to read the
5 results.

6 The indications could also be divided into common
7 indications and rare indications. You cannot demand as much
8 results if you have a rare indication. You can't demand
9 having studies with 500 implants if there are only 100
10 patients who need replacement for that site. You have to
11 divide indications into temporary use or permanent use.

12 When we talk about control or success criteria or
13 studies, it is at the endpoint. It is important that you
14 check your implants at the endpoint and not start
15 calculating the date from when it is inserted in the
16 patient. This goes back to when you start to do the
17 statistical evaluation, cumulative success rates are
18 extremely good, especially if you use the life table model,
19 but you have to tell how many of the implants were actually
20 followed for the entire study period because the life table
21 is designed to give you very good prognostic results even if
22 not all implants are not followed, and that is the
23 difference between a controlled study where you have an
24 endpoint where you are checking your results.

1 You also have descriptive statistics. That is,
2 for instance, simple percentages where you only take failed
3 versus inserted implants. Of course, if you do a controlled
4 study, you can start to talk about significance tests, and
5 there we have the real clue if the implant system is
6 significantly better or not.

7 (Slide)

8 We looked a little bit at some of the research we
9 have done, and we listed it. First of all, we have the
10 author and the title of the study, and this is for
11 edentulous mandibles. Then we have the purpose of the
12 study, which I think is extremely important. Not all
13 studies were done to prove safety and efficacy for an
14 authority. They were done to show how an implant system
15 works in my hands in my clinic.

16 We also want to know the number of implants and
17 patients, both at the start at the study but, just as
18 important, at the end of the study. We want to know the
19 time of follow-up and withdrawals. We want to know the
20 survival rate, and if we talk about cumulative survival
21 rates we also want to know that at least 75% of the patients
22 were actually followed for that period for which we claim
23 that we have documented. Of course, we want to have studies
24 repeated by independent people.

1 (Slide)

2 We can do the same for edentulous posterior
3 maxillae. When we made the list, we went through it and if
4 we found two studies that did support the safety and
5 efficacy for that indication, we did not list all of them
6 and, as you can see here, we have very success rates for
7 this indication.

8 (Slide)

9 We can move on to the so-called zygoma implants.
10 Here we have only an internal report according to standard
11 EM 540. We know the purpose of the study. We know the
12 number of implants, the time of follow-up and withdrawal.
13 And, the survival rate is very high for this but limited.
14 Not all patients have been through the final follow-up.
15 Their time period has not been five years since all of the
16 patients were treated. We do, of course, have failure and
17 success criteria defined, and we have an endpoint follow-up.

18 (Slide)

19 Finally, if we look at when implants are used for
20 temporary periods, it is when you are using them for
21 orthodontic anchorage, and we could divide that into two
22 subgroups. One is if you place the implant in the dental
23 ridge and use it temporarily as an orthodontic anchorage,
24 which has been published a lot, of we can look at the new

1 kind of treatment where you place the implant in the palate,
2 in a different type of bone, where we have limited
3 documentation so far but we are still using the same type of
4 implant, the same design, the same surface, and then we are
5 only claiming it for short periods. So, here we believe
6 that you only need short period follow-up.

7 (Slide)

8 So, in closing this presentation, I definitely
9 recommend class II for all screw-shaped implants in
10 titanium. I also recommend class II for temporary or zygoma
11 implants, temporary implants because they are only used for
12 short term and that is why they should only need short-term
13 documentation. Zygoma implants, due to the patient benefit,
14 even if the results there are limited, they are very
15 promising.

16 Thank you very much for giving me the opportunity
17 to talk here.

18 DR. GENCO: Thank you, Dr. Herrmann. Any
19 questions or comments from the Panel? Would you just go
20 over the zygoma implant again? Something like 50 cases or
21 84 implants, something like that?

22 DR. HERRMANN: Yes. Could you put on the zygoma
23 slide again, please? We have 50 patients, 89 implants, and
24 43 of the implants have had their endpoint follow-up after 3

1 years. Some of them, 20, have been evaluated after 5 years
2 and the cumulative success rate at 5 years is 94.4%, and
3 that is, as I said before, a good prognosis since we are
4 using the same design, the same material and the same
5 surface.

6 DR. GENCO: Have you entered into any special
7 training for the surgeons or the prosthodontists?

8 DR. HERRMANN: For the zygoma we do have a special
9 training program, both for surgeons and prosthodontists,
10 which are run by Prof. Branemart himself.

11 DR. GENCO: So, if they were classified, this
12 might be a condition.

13 DR. HERRMANN: Yes, I think that might be a
14 condition, that you would demand special training or
15 something like that. Thank you for asking me that question
16 because I think that is also something I did not mention.
17 Of course, if you have special training, or something, or if
18 you are claiming that you have an implant that would work
19 better in a specific site, you have to let people know that.

20 DR. GENCO: Any other comments or questions?

21 (No response)

22 Thank you very much.

23 DR. HERRMANN: Thank you.

24 DR. GENCO: The next presentation is by Dr. Paul

1 Armstrong, from Innova Corporation. Dr. Armstrong?

2 **Presentation by Mr. Michael Kehoe**

3 MR. KEHOE: My name is Mike Kehoe. I am President
4 of the Innova Corporation. I would just like to outline a
5 bit about the corporation structure and then I will turn the
6 presentation over to Dr. Paul Armstrong with regard to our
7 clinical data, and Dr. Robert Pilliar, from the University
8 of Toronto, with regards to the physical characteristics of
9 the implant.

10 (Slide)

11 Innova Technology is a public corporation, with
12 our corporate head office in Toronto, Canada. We have
13 facilities in San Francisco and Sydney, Australia. We have
14 met the regulatory requirements for the Endopore system in
15 Japan, Taiwan, Australia, New Zealand and Canada. As well,
16 we have a 510(k) notification clearance in the U.S., as well
17 as an approved IDE from early 1992. We have active research
18 programs in other product areas.

19 (Slide)

20 Clinical history of the Endopore -- the Endopore
21 was developed in 1983, and after preclinical studies animal
22 studies in 1986-87 we began implanting humans in January,
23 1989. In 1992, we received approval for an investigational
24 device exemption to conduct prospective clinical trials at

1 three centers in the U.S., and in 1994 we received approval
2 by the Ministry of Health in Canada and the Therapeutic
3 Administration in Australia. In 1995, we submitted all our
4 relevant data at that time to FDA and received approval to
5 sell in February of 1995. In 1996, we received approval
6 from the Ministry of Health and Welfare in Japan based on
7 clinical studies.

8 To date, we have sold about 40,000 implants
9 worldwide since releasing the product, and we have
10 continuing prospective clinical trials in four countries, at
11 six centers, which now include over 400 patients and about
12 1100 implants for mandibular overdenture and partially
13 edentulous indications. We have about 30 publications in
14 various peer-reviewed journals globally.

15 I would like to introduce Bob Pilliar, from the
16 University of Toronto, Director of the Center of
17 Biomaterials, to speak to the physical characteristics of
18 the implant.

19 **Presentation by Dr. Robert M. Pilliar**

20 DR. PILLIAR: I am Dr. Bob Pilliar, from the
21 University of Toronto. I am on the faculty of dentistry and
22 also I am Director of the Center for Biomaterials at the
23 University of Toronto.

24 (Slide)

1 My interest in this implant, the Endopore implant,
2 comes from my being a co-inventor of the device. In
3 accordance with that, I share in certain royalties which are
4 given to the university through normal university
5 agreements. I also have an interest in terms of being a
6 shareholder of this public company, and I am also being paid
7 for this day's visit down here, to Washington.

8 (Slide)

9 I want to tell you about the geometry of this
10 device. The Endopore implant system is made with a surface
11 region. First of all, it is a cylindrical shaped system.
12 It would fall into the grid of construction that I have seen
13 this morning -- it would fall into the porous metallic-
14 coated cylinder category, a two-stage implant procedure.
15 The implant itself has a slightly tapered cylindrical
16 geometry, and it has a porous surface zone which is roughly
17 300 microns in thickness, which allows bone ingrowth to
18 occur into it. So, again, it falls into that category of
19 implants fixed by bone ingrowth into these porous zones.

20 The porosity itself represents roughly 35 volume
21 percent of that surface zone. The implant, as you see,
22 comes in three lengths, 7 mm, 9 mm and 12 mm lengths. Not
23 included here is the fact that the implant itself has a hex
24 portion of the abutment which is compatible with industry

1 practice at this time.

2 (Slide)

3 This is a slide which depicts this implant system.

4 You see here the cylindrical shape, the slight taper and
5 this porous surface zone.

6 (Slide)

7 The porous surface region represents a zone which
8 is integrally bonded to the underlying solid, dense portion
9 of the implant. That porous surface region is formed by
10 sintering beads or particles, powder particles in that
11 surface region. The sintering operation itself results in
12 this integrally bonded surface zone which has this required,
13 or desired, porosity for bone ingrowth to occur into it. As
14 I have indicated earlier, that surface zone represents
15 roughly 35 volume percent porosity.

16 (Slide)

17 I think it is important to describe to you what
18 exactly the sintering process is. It is a process by which
19 you take these particles and go through a solid state
20 diffusion process, which causes the particles to
21 consolidate, to become one both with themselves and with the
22 solid core placed over it. So, we end up, after the
23 sintering treatment, with a one-piece unit but it has on the
24 surface openings which are intended for bone ingrowth. So,

1 it is a process by which we can create this required
2 geometry of a structure which is able to bear the loads
3 applied to it, but which also has these openings that bone
4 can grow into. You could say that it is an alternative
5 means of forming surface holes or surface openings into the
6 device. And that is what it is, and you must appreciate
7 that what we have here is this integral component, this
8 structure that has this porous surface zone associated with
9 it.

10 With that, I am going to pass over the podium to
11 Dr. Paul Armstrong.

12 **Presentation by Dr. Paul Armstrong**

13 DR. ARMSTRONG: My name is Paul Armstrong. Innova
14 has paid my expenses here today, and since Innova is a
15 public company I do own some stock in the company.

16 (Slide)

17 I am an Associate Professor of Clinical Dentistry
18 at the University of Kentucky, in Lexington, and have a
19 private practice limited to periodontics and the implant
20 dentistry. I am also a clinical investigator for the Innova
21 Endopore Corporation. I have placed in excess of 5000
22 implants over the last 19 years. My success rate has been
23 comparable to or slightly better than what has been reported
24 in the literature. Since 1993 I have placed over 500

1 Endopore implants in all areas of the mouth.

2 I am impressed with the excellent results that I
3 have obtained. Clinical data demonstrates that the Endopore
4 system is not only safe and effective for the patient, but
5 results are comparable or exceed those published in the
6 literature for the other implant systems.

7 (Slide)

8 This slide was begun in January of 1989, at the
9 University of Toronto, and it shows the results of the
10 University of Toronto mandibular overdenture population, 156
11 implants were placed in 52 patients, with follow-up of 7
12 years in function and a success rate of 93.4%.

13 Single-tooth implants were also placed at the
14 University of Toronto maxilla, 20 patients, 20 implants.
15 The follow-up is one year in function, with a success rate
16 of 100%. The same protocol is used virtually in all
17 prospective trials, including the IDE study.

18 (Slide)

19 This study is being conducted at 3 U.S. centers
20 and has been ongoing since 1992. In the IDE study for the
21 mandibular overdenture population 275 implants were placed
22 in 92 patients, followed for 3 years in function with a
23 success rate of 94.2%. In the partially edentulous
24 population, 420 implants were placed in 179 patients, with 2

1 years follow-up and a success rate of 96%. The success
2 rates are equal to or better than what is reported in the
3 literature for the Branemart study.

4 (Slide)

5 This slide of the mandibular overdenture studies
6 shows that the University of Toronto study, with 7 years
7 postop data and the IDE study with 3 years postop data have
8 almost identical success rates.

9 (Slide)

10 Comparable partially edentulous success rates
11 between the two studies are shown in this slide, the
12 University of Toronto and IDE study.

13 (Slide)

14 This slide illustrates the success rates by
15 implant location. As you can see, there is no appreciable
16 difference in the success rates, and all remain well within
17 the rate shown in the literature to be acceptable.

18 (Slide)

19 The mean cumulative bone loss at 4 years is less
20 than 1 mm.

21 (Slide)

22 The evaluation of the Endopore implant resulted in
23 normal ranges seen in natural teeth for the parameters shown
24 on this slide.

1 (Slide)

2 A summary of success rates results from studies of
3 Endopore implants for similar follow-up are comparable to
4 Branemart's success rates. Please note the results from the
5 1987 and 1988 Branemart papers. The Panel considered these
6 papers in recommending reclassification of the Branemart
7 implant in 1991. These results are similar to the Endopore
8 results.

9 (Slide)

10 The physical characteristics and the surgical
11 placement technique for the Endopore implant are similar to
12 many other endosseous implants for the purpose of
13 reclassification.

14 (Slide)

15 Clinical data support reclassification of the
16 Endopore implant system to class II. Special and general
17 controls provide a reasonable assurance of safety and
18 effectiveness for a class II designation.

19 I would like to strongly recommend that the
20 cylindrical porous-coated implants be reclassified into the
21 class II category. Thank you.

22 DR. GENCO: Thank you, Dr. Armstrong. Are there
23 any comments or questions from the Panel? Yes, Dr. Heffez?

24 DR. HEFFEZ: I would just like to solicit your

1 opinion on the classification that is provided. It refers
2 to the different implants but it doesn't refer to any of the
3 abutments. Do you feel that a subclassification of
4 abutments would be indicated as well?

5 DR. ARMSTRONG: You mean what the earlier speaker
6 spoke to or addressed as far as leaving them out of class
7 II?

8 DR. HEFFEZ: No.

9 DR. ARMSTRONG: Would you restate your question?

10 DR. HEFFEZ: All right. This particular implant,
11 for example, was classified using the classification as
12 proposed, as a porous, metallic-coated cylinder.

13 DR. ARMSTRONG: Right.

14 DR. HEFFEZ: But we don't have any listing of
15 abutments that fit on each particular implant. I would like
16 to solicit your opinion of whether you feel that we should
17 be classifying the different types of abutments that are
18 available as well.

19 DR. ARMSTRONG: Well, the abutments that are for
20 these implants are standard abutments. They are compatible.
21 I mean, any abutment type is the same type as placed on the
22 Endopore implant.

23 DR. HEFFEZ: I understand that, but my question is
24 whether you think those abutments should be classified as an

1 angled abutment, straight abutment, or whether they should
2 not be considered.

3 DR. ARMSTRONG: Well, I really don't understand
4 because we do use straight and angled abutments on the
5 Endopore implants.

6 DR. GENCO: Maybe I can help. The FDA has asked
7 the Panel to look at abutments per se for classification --

8 DR. ARMSTRONG: Right.

9 DR. GENCO: -- in a similar manner to the
10 implants.

11 DR. ARMSTRONG: I don't think these abutments
12 should be in a special class. I am sorry.

13 DR. GENCO: Dr. Armstrong, in your experience or
14 do you have any data in your studies or the company's
15 studies with respect to treatment of failing implants, not
16 those that you have to take out but those that may have
17 trenching or loss of tooth, 3 mm or 4 mm around the coronal
18 portion? There is quite a bit of interest, as you know, in
19 the periodontal community in treating these with
20 regenerative therapies, what-have-you. From the strictly
21 mechanical point of view, one could argue that the smoother
22 the surface, maybe the greater the potential for
23 regeneration and here you have an implant with these large
24 beads. What is your experience, or what is the data with

1 respect to treatment of these failing implants?

2 DR. ARMSTRONG: I think I can address that.

3 Number one, we don't see too much of an ailing implant, if
4 you will, in this particular implant simply because the
5 forces placed on the bone seem to make the bone more dense
6 in the coronal portion. But if we do have a problem of an
7 ailing implant, and of the 500 implants I have placed we
8 have had 2 implants where the beads were exposed, 1 of them
9 which was just due to poor oral hygiene; the other, the
10 crown was simply too large. But to answer your question, I
11 have used the technique that has been described by Raleigh
12 Meffort, Mark Zoblosky and Sasha Jovanovich where we can
13 reflect the flap and go in and remove the bead, because
14 there is a solid core titanium alloy underneath the beads,
15 and then micropolish can be used and detoxified with citric
16 acid. Again, of the 2 implants, 1 of them is 6 months out
17 and the other one is about a year out and they have remained
18 healthy.

19 DR. GENCO: Thank you. Janine?

20 DR. JANOSKY: You reported on some clinical
21 studies and you used the outcome variable as success. Can
22 you please tell me what the operational definition of
23 success was? Was it the same in each of those clinical
24 studies that you reported?

1 DR. ARMSTRONG: Of the success rate?

2 DR. JANOSKY: Yes. How were you defining success
3 is the question that I am asking.

4 DR. ARMSTRONG: You define success as no mobility,
5 no pain, bone loss less than 1.2 mm in the first year and
6 two-tenths thereafter, and absence of pain.

7 DR. JANOSKY: So all of those must be present to
8 be considered a success?

9 DR. ARMSTRONG: I am sorry, would you say that
10 again?

11 DR. JANOSKY: Must all of those be present for it
12 to be considered successful?

13 DR. ARMSTRONG: Yes.

14 DR. JANOSKY: A follow-up question, the study that
15 you reported that was followed for one year, the success
16 rate was 100%, if I remember correctly.

17 DR. ARMSTRONG: Right.

18 DR. JANOSKY: And the one that you reported for 5
19 years, it was approximately 93%.

20 DR. ARMSTRONG: Yes.

21 DR. JANOSKY: Clearly different populations, etc.
22 When are you finding the drop-offs? Are they occurring a
23 year and a half, two years, or is it all the way up to the
24 three years where you are seeing that drop in success rate?

1 DR. ARMSTRONG: You are talking about the failure?

2 DR. JANOSKY: Right, exactly.

3 DR. ARMSTRONG: My personal observation has been
4 that if you get into an ailing situation, it is going to
5 happen within the first year. In other words, if there is
6 occlusal overload or infection, that is going to happen in
7 the first year. Did I answer your question?

8 DR. JANOSKY: That is somewhat confusing to me
9 because in that one study you were reporting -- I don't know
10 if that was done in Kentucky, but you had 20 subjects and 20
11 implants --

12 DR. ARMSTRONG: That was University of Toronto.

13 DR. JANOSKY: That was one year follow-up and 100%
14 success rate.

15 DR. ARMSTRONG: Right, in that small population.
16 I mean, that is just the way it was.

17 DR. GENCO: Any further comments or questions from
18 the Panel?

19 (No response)

20 Thank you very much, Dr. Armstrong.

21 DR. ARMSTRONG: Thank you.

22 DR. GENCO: The last presentation this morning is
23 by Mr. Kermit Stott, from Sulzer/Calcitek.

24 **Presentation by Mr. Kermit Stott**

1 MR. STOTT: Good morning. I am Kermit Stott, Vice
2 President of Operations and Regulatory Affairs, Sulzer/
3 Calcitek. I will make brief introductory remarks prior to
4 our principal presentation by Dr. Bill Wagner.

5 Since 1985, Sulzer/Calcitek has manufactured
6 endosseous implants, including HA-coated cylinders and
7 screws. These implants have documented successful
8 performance, and are produced under strict and well-defined
9 manufacturing controls. Because of Sulzer/Calcitek's
10 extensive work in the development and refinement of HA-
11 coatings, our focus this morning will be on the
12 reasonableness to reclassify HA-coated dental implants into
13 class II.

14 FDA law seeks to regulate devices at the lowest
15 appropriate level, which was the reason for a device
16 classification system with varying controls. Class III
17 devices were those which presented a significant level of
18 risk, and for which not enough was known about the device to
19 place it in class I or II. Class II devices can have the
20 same risk profile as a class III device but more is known
21 about them.

22 Intensive product by product class III approvals
23 were unnecessary for class II devices because special
24 controls and general controls under FDA law will ensure

1 DR. WAGNER: Thank you, Kermit. Good morning.

2 As a result of Calcitek's market success with the
3 HA-coated integral implants, starting in the mid-1980s, most
4 of the dental implant manufacturers quickly introduced HA
5 implants of their own. Nearly all of these competitive
6 implants were coated by plasma-spray coating vendors who
7 offered quick product development time lines with minimal
8 investment on the part of the dental implant manufacturers.
9 Soon, the marketplace was awash in implants identically
10 labeled as HA.

11 This rush to market out-paced the development of
12 accurate characterization methods that could ensure that
13 these products met some minimum quality standard. Moreover,
14 data from clinical research did not exist to correlate HA-
15 coating characteristics with clinical success. Ten years
16 ago the general level of understanding of hydroxylapatite
17 and similar materials was by today's standards quite
18 primitive. It was generally believed that the coatings
19 offered good biocompatibility and other advantages. The
20 things that weren't generally well understood, particularly
21 by manufacturers trying to rush to meet a perceived market
22 opportunity, led to today's confusion about the safety and
23 effectiveness of HA coatings and HA-coated implants.

24 High quality HA coatings are not easy to produce.

1 Poor quality coatings, on the other hand, can be very easily
2 made, and right now neither labeling nor visual inspection
3 can be used to distinguish between high and low quality.
4 Good characterization techniques for HA, essential for
5 product consistency, were until recently not widely
6 available. However, with today's technology one can readily
7 determine the quality of an HA coating.

8 Sulzer/Calcitek acknowledged the concerns voiced
9 in the past about the quality of HA coatings. We have read
10 the journal articles and the letters that created this
11 concern in our industry. Once entrenched, fear cannot
12 easily be overcome, at times even with a mountain of solid
13 information. The journal articles that raised the level of
14 concern are often unscientific, anecdotal clinical reports
15 of rapid HA-coating dissolution and easily spalled coatings.
16 Importantly, nearly every animal study using HA coatings
17 that has been published offers little or no characterization
18 of the coating, and this makes up a large part of the
19 alarming literature. HA has been branded as problematic by
20 such imprecise literature.

21 (Slide)

22 This chart shows the results of an analysis
23 performed at New York University of recent lots of various
24 commercially available HA-coated dental implants. Even a

1 cursory look at this chart instantly reveals the concern
2 with HA coatings.

3 The problem is not safety or effectiveness, but
4 that each of these coatings is being labeled and evaluated
5 as if they were the same. A coating with only 38%
6 crystalline HA content has absolutely no bearing on
7 Calcitek's HA coatings with substantially higher HA levels.
8 The scientific literature clearly equates high crystalline
9 HA content with stability.

10 (Slide)

11 One way to represent our implant success is by
12 reviewing the data generated by our internal quality system.
13 This graph shows the cumulative number of Sulzer/Calcitek's
14 dental implants sold over a nine-year period, from 1988
15 through 1996. It also shows the total number of reported
16 implant failures during the same time period. This chart
17 shows total implant failures reported, irrespective of the
18 cause of failure and including failures occurring pre- and
19 post-restoration. Granted, this likely does not capture
20 every failed implant, but we have a liberal return and
21 product replacement policy that gives our customers a strong
22 incentive to report failures. In total, over this nine-year
23 period, only 0.4% of the implants we sold were reported as
24 failures. This is a powerful demonstration of the

1 significance of a high quality HA coating.

2 Calcitek's interim prospective clinical trial
3 data, providing a more scientific assessment, reports
4 outstanding results for our HA-coated implants.

5 (Slide)

6 These data come from Ohio State University, one
7 site in our ongoing multicenter study on these implants.
8 Given the short notice of this meeting, we didn't have
9 enough time to update and present all of our sites,
10 something we plan to do in time for the next Panel meeting.

11 These data represent 117 patients, consecutively
12 enrolled between February of 1991 and May of 1993, who
13 received and had restored a total of 416 calcitite HA-coated
14 cylinder implants. As of August of this year, the mean
15 follow-up is 4.1 years. Of the 416 implants placed in this
16 study, only 17 have been removed from a total of 6 patients.
17 Based on a life table analysis, the cumulative success rate
18 has been 99% at 3 years and 92% at 5 years.

19 Sulzer/Calcitek's experience with HA-coated
20 implants has not been one of coating-related complications.
21 Significantly I believe, our experience has been one of
22 consistent coating quality, careful process control and
23 thorough coating characterization. The tools we use to
24 achieve high quality HA coatings are readily available to

1 all in the industry.

2 X-ray defraction is the most powerful analytical
3 technique used to characterize HA coatings. We published
4 our own x-ray method for all to review and use in order to
5 improve the standard level of HA quality industry-wide.
6 Ours is not the only method available to manufacturers, nor
7 is it necessary for companies to invest in their own x-ray
8 defraction hardware. Commercially available analytical
9 services can also be accessed.

10 In short, there is no acceptable excuse for anyone
11 to continue producing a substandard HA coating, or to offer
12 that coating without full disclosure of its contents.

13 That being said, how should FDA regulate HA
14 coatings? Are they still mysterious and do they pose enough
15 incremental risk to warrant a class III classification? We
16 think not. Moreover, FDA itself has already decided in the
17 case of HA-coated hip prostheses that class II is most
18 appropriate. For example, our sister company, Sulzer
19 Orthopedics, received 510(k) clearance earlier this year on
20 an HA-coated hip stem. This product has the same calcitite
21 HA coating that we have been applying to dental implants for
22 over ten years. Sulzer Orthopedics clinical trials
23 demonstrated that the HA-coated implant performed as well or
24 better than the uncoated version of the same device.

1 FDA's decision to classify this particular hip
2 stem as class II did not set any precedent. In fact, FDA
3 has been regulating HA-coated hip prostheses as class II for
4 seven years.

5 (Slide)

6 This list shows about 50 HA-coated hip prosthetic
7 devices cleared by 510(k) between December, 1990 and May,
8 1997. It would be unreasonable to argue that HA-coated
9 dental implants pose a greater risk to patients than HA-
10 coated prostheses. The morbidity associated with failed hip
11 prostheses and the trauma patients must endure to have them
12 replaced cannot be compared with that of dental implants.
13 FDA has already decided that HA-coated orthopedic implants
14 can be regulated as class II devices. How then can one
15 justify the position that HA-coated dental implants require
16 more regulatory control than these articular, weight-bearing
17 prostheses?

18 (Slide)

19 Our recommendation to this Panel and to the FDA is
20 that with special controls HA-coated dental implants be
21 reclassified to class II.

22 We recommend that FDA impose special controls that
23 require manufacturers meet certain minimum coating quality
24 specifications that focus on keeping the crystalline HA

1 content above 70%, and the adhesion strength of the coating
2 to the implant body above 5000 p.s.i. In the interest of
3 time I won't go into depth on the specific values, but
4 clinical trials have shown that devices that meet these
5 specifications are successful.

6 We also recommend that HA coatings that do not
7 meet these specifications remain in class III, and require
8 clinical data for marketing approval because not enough is
9 known about such coatings. Manufacturers have access to the
10 tools needed to comply with these special controls, and the
11 FDA Office of Compliance has the ability to inspect and
12 audit manufacturers to ensure that these special controls
13 are effective and are followed.

14 I thank you for giving us an opportunity today to
15 present this information. We look forward to the next Panel
16 meeting where we will give you more details, and let our
17 clinical study investigators and some academic experts
18 address you directly to further support our recommendations.
19 Thank you.

20 DR. GENCO: Thank you, Dr. Wagner. Any comments
21 or questions from the Panel?

22 DR. REKOW: I would like to ask a follow-up
23 question, the same one actually that Janine asked. When do
24 you see the failures? The one study you showed suggested

1 that you are seeing failures in three or four years. Other
2 studies suggested that maybe they occur in the first year.
3 What is your impression of when failures occur?

4 DR. WAGNER: I think that I agree with the
5 previous speaker that, in general, most implant failures
6 occur during the first year after they are placed. Now,
7 typical life table analyses, however, do show a gradual
8 drop-off in cumulative success rates over long periods of
9 time.

10 DR. REKOW: Due to a different mechanism over
11 time?

12 DR. WAGNER: I don't think I am qualified to
13 address that specific question, but I think that it is well
14 accepted at this point that most of the failures that occur
15 in clinical studies of this type tend to occur early, and
16 they tend to be focused on a very small number of patients.
17 We see that most of the implant failures do come from one or
18 two, or a small number of patients who have a particular
19 problem.

20 DR. REKOW: Thank you.

21 DR. JANOSKY: Just to continue along that line for
22 a second, because I notice that your data seem somewhat
23 different from what you are saying and also from what I
24 heard previously, if I look at your time to event analyses,

1 it looks like failures aren't happening till year three. Is
2 that true? Am I misinterpreting what you presented?

3 DR. WAGNER: That particular graph showed so, yes.
4 I would like to caution the Panel, however, that this is one
5 site in a multicenter study and we will provide you with
6 more information on all of the sites in time for the January
7 meeting.

8 DR. GENCO: It seems that if you have a failure
9 rate of 5% or 10%, comparable to non-coated implants, then
10 this question of what advantages there are to the coating
11 comes up. Secondly, are there any disadvantages,
12 particularly with reference to the point made before, that
13 is, treatment of the ailing implant, that is ailing for
14 peri-implantitis? So, do you have any information with
15 respect to those two issues? What is the advantage and what
16 are the disadvantages of having the coating?

17 DR. WAGNER: First of all, Sulzer/Calcitek also
18 manufactures and markets non-HA-coated dental implants,
19 including machined and textured and TPS coatings. For us,
20 the availability of an HA coating is really one of choice,
21 one of preference on the part of the clinicians. I am not
22 here today to argue a superiority claim or particular
23 advantage for HA coatings. What I am here to advocate is
24 that the data show that high quality HA coatings can be used

1 safely and effectively, and there clearly is a large number
2 of clinicians who have a preference for these implants.

3 DR. GENCO: With respect to the treatment of the
4 failures, again, the point is that if you have a smooth
5 surface it might possibly be better to get regeneration or
6 resolution of peri-implantitis as compared to a roughened
7 surface that is exposed to the oral cavity. Do you have any
8 data with respect to that?

9 DR. WAGNER: The only thing I would offer would be
10 to refer the Panel to the well-known works of Dr. Meffort
11 and Zablosky on the treatment of ailing HA-coated implants.
12 The treatment regimens that they have been using and
13 advocating for a number of years now appear to be very
14 successful but, other than that, I don't have anything new
15 to offer to you today.

16 DR. GENCO: Thank you.

17 DR. WAGNER: Thank you.

18 DR. DRUMMOND: You made several comments on
19 crystallinity. Do you have studies relating to solubility
20 of crystallinity?

21 DR. WAGNER: Yes, we do have in vitro solubility
22 data, which is in the process right now of being published.

23 DR. DRUMMOND: Why did you pick 70?

24 DR. WAGNER: We picked 70 because that is the

1 crystalline HA content at which we can offer you clinical
2 data. That reflects Calcitek's successful clinical
3 experience.

4 DR. DRUMMOND: Do you have studies relating to,
5 say, 50% crystallinity to 70% crystallinity?

6 DR. WAGNER: In terms of what?

7 DR. DRUMMOND: Success.

8 DR. WAGNER: Clinical success? No, I am unaware
9 of prospective clinical trials that correlate those things.

10 DR. DRUMMOND: On your hip implant, is that
11 entirely coated with HA or just selected areas coated with
12 HA?

13 DR. WAGNER: Most, if not all HA-coated hip
14 prostheses are coated on the acetabular cup and also at the
15 apical end of the implant, not over the entire hip stem but
16 at the top.

17 DR. DRUMMOND: Do you want to correlate an implant
18 that is 100% coated with an implant that is only partially
19 coated?

20 DR. WAGNER: I have no information to offer you on
21 that.

22 DR. GENCO: Further comments or questions? If
23 not, thank you very much, Dr. Wagner.

24 DR. WAGNER: Thank you.

1 DR. GENCO: Now Pamela Scott has some
2 announcements.

3 MS. SCOTT: Just before we break for lunch, I
4 would like to remind the Panel members and consultants to
5 check your calendars for a January meeting date. Also, I
6 would like to let you know that there is a reserved section
7 in the hotel restaurant for the Panel.

8 DR. GENCO: Thank you very much. What we will do
9 then is break for lunch and please return at one o'clock.
10 Mr. Don Kennard, from Steri-Oss, will make a presentation at
11 1:00 promptly. Thank you.

12 (Whereupon, at 11:55 a.m., the proceedings were
13 recessed, to be resumed at 1:00 p.m.)

1 AFTERNOON SESSION

2 DR. GENCO: We have an announcement by Pamela
3 Scott first.

4 MS. SCOTT: Just one quick item that I need to
5 read into the record. The date of the conflict of interest
6 statement is relevant to November 4th and 5th, 1997.

7 DR. GENCO: Thank you. We will start this
8 afternoon with Mr. Don Kennard, from Steri-Oss.

9 **Presentation by Mr. Don Kennard**

10 MR. KENNARD: Good afternoon. As a point of
11 introduction, I am the Vice President of Research and
12 Development for Steri-Oss. My responsibilities include
13 research and development, regulatory affairs, clinical
14 studies and quality assurance. I have over two decades of
15 experience in these disciplines with drug, device and
16 biologic products, and six years of experience with
17 endosseous dental implants.

18 Panel members and staff have the challenge of
19 determining the final classification of endosseous dental
20 implants. The possibility that some or all forms of
21 endosseous dental implants may require premarket approval
22 submissions and maybe removal from availability is one of
23 the potential outcomes of these proceedings. This occurs at
24 a time when endosseous dental implants have a long history

1 of safety and efficacy in the United States under regulatory
2 control at the 510(k) level. The extent of that history
3 includes over 440 510(k) submissions found to be acceptable
4 for clearance to market, involving 98 different sponsors
5 from 1977 through 1996. In addition, the U.S. public has
6 had experience, extensive exposure and acceptance of
7 endosseous dental implant therapy.

8 Based on a 1995 United States usage survey of
9 endosseous dental implants by Medical Data International and
10 the American Dental Association's 1991 special version
11 survey of dental practice, it is estimated that over one
12 million patients have been treated with endosseous dental
13 implant therapy from 1985 through 1995. This would represent
14 over three million implants being placed.

15 Additionally, the current annual number of
16 patients benefiting from endosseous dental implant therapy
17 is over 150,000 patients, again, representing close to
18 500,000 implants a year.

19 The widespread acceptance and usage of endosseous
20 dental implants demonstrates the accepted utility, benefit,
21 safety and efficacy of this therapy by the dental profession
22 and the United States public. It further underscores the
23 adequacy of the 510(k) route for regulatory approval and
24 controls currently in place.

1 Panel members and staff, you face a unique
2 challenge. The adequacy of the current controls has been
3 well established over the last two decades. However, you
4 need the scientific data that define the levels of safety
5 and efficacy for each of the categorized types of endosseous
6 dental implants in order to justify the continued use of the
7 existing controls. The manufacturers can provide that
8 information but additional time is required.

9 Steri-Oss received our notification that we would
10 be able to provide data to the Panel on September 10 of this
11 year, and the data would be needed to be presented to the
12 Panel by October 8 for this November 4 meeting, an
13 inadequate period of time to assemble all of the relevant
14 data, and an inadequate period of time for the Panel to
15 digest that data by this meeting. I am encouraged that we
16 will have another meeting in January.

17 In order to begin the process, Steri-Oss provided
18 the Panel with a full bibliography of journal articles that
19 address the Steri-Oss product line. This information is
20 extensive, over 130 journal citations regarding the
21 scientific inquiry and clinical studies of Steri-Oss
22 products. This information meets the FDA requirements of
23 available public evidence and valid scientific evidence.
24 It, however, is only one subset of the available data.

1 Before, and since the last substantive Panel
2 meeting regarding reclassification, on October, 1991,
3 manufacturers have been conducting well-designed and
4 controlled clinical trials. Some of these studies are
5 ongoing. This is the data that needs to be reviewed by the
6 Panel to make informed judgments regarding the safety and
7 efficacy of the products. As this data collection was
8 designed to demonstrate safety and efficacy, it represents
9 the only data set that can truly determine safety and
10 efficacy. However, many of these studies are ongoing and
11 data summaries and statistical analyses have yet to be
12 completed and be ready for submission.

13 This is the type of data that the Panel's peers at
14 the American Dental Association Scientific Council review in
15 order to grant acceptance into the ADA's acceptance program.
16 That program has found the following product types to meet
17 their requirements: titanium threaded EDIs, hydroxylapatite-
18 coated threaded EDIs, hydroxylapatite-coated cylindrical
19 EDIs, titanium plasma-sprayed coated cylindrical EDIs, and
20 blade implants.

21 Further, the American Dental Association
22 requirements for acceptance are the most rigorously
23 established requirements in the world. Additionally, in
24 1993, Dr. John Stanford, President of the ADA Council on

1 Dental Materials, stated, quote, from the amount of clinical
2 evidence presented to the council thus far, the long-term
3 clinical success of osseointegration appears to have been
4 demonstrated, unquote.

5 Thus, we encourage FDA staff and the Panel to
6 allow sufficient time to provide the manufacturers with the
7 ability to prepare, analyze and submit to the Panel the same
8 breadth and depth of information submitted to the ADA
9 council, such that a fully informed judgment can be rendered
10 reclassification.

11 The Panel members and FDA staff are additionally
12 faced with the challenge at a time when FDA has been granted
13 broadened powers of surveillance and enforcement under the
14 new quality system requirements. These new requirements add
15 further levels of protection to the public under the
16 established general controls of the 510(k) route to market.
17 Additionally, FDA has recently proposed new approaches to
18 the 510(k) approval process, entitled, the new 510(k)
19 paradigm, with the express intention to conserve FDA's
20 review resources. As the Agency searches to improve
21 responsiveness to the public while protecting the health of
22 the public, it would appear counterproductive to require
23 lengthy and time-consuming, expensive review of PMAs by the
24 Agency when the products have been adequately controlled

1 through the 510(k) process over two decades.

2 Thus, I urge you to provide the necessary time to
3 manufacturers to assemble, analyze and submit their ongoing
4 clinical studies and their past submissions to the ADA, such
5 that the compelling data that was presented to Dr. Stanford
6 will also be made available to you for deliberation.

7 Additionally, given the long-term commercial
8 history of the products and the Agency's need to maximize
9 resources, we would request you make your judgments as broad
10 as possible to include as many categories of products as
11 possible, and to allow staff the opportunity to make
12 informed assessments in the future. Thank you.

13 DR. GENCO: Thank you. Any comments or questions
14 from the Panel?

15 DR. HEFFEZ: I would like to ask you two
16 questions. One is, could you tell us your experience
17 specifically with your blade implant?

18 MR. KENNARD: We have not conducted ongoing
19 clinical studies with our blade implant. We have one paper
20 presented by Jack Hahn, back in 1987. It was a case study
21 of 20 patients that had blade implant therapy. We have not
22 done prospective trials on that. But I am very familiar
23 with Dr. Kapur's work on the Oratronics product, and that is
24 substantive information. If this Panel does not have that

1 information, the Panel should be made aware of that. It
2 part of the DIMA petition.

3 DR. HEFFEZ: My second question would be that I
4 would like to solicit your opinion as far as abutments,
5 whether you feel abutments are diverse enough that they
6 should require a separate subclassification.

7 MR. KENNARD: Well, I think you have to start with
8 material type. Ceramic abutments may be different than
9 titanium abutments. Then I think you have to work your
10 classification through the material type and then
11 applications that could reflect geometry, degrees of
12 angulation etc. That should lead you to a path of
13 classification that would be appropriate.

14 DR. HEFFEZ: So, your statement would be yes,
15 there should be a separate classification for abutments?

16 MR. KENNARD: I think there should be a separate
17 consideration; I don't know if it should be a separate
18 classification. I think the FDA has the vehicle within
19 their guideline documents to provide the instruction and
20 direction to manufacturers to ensure that adequate clinical
21 trials with exotic materials, or unique angulations, or
22 unique designs of abutments are presented, such that the
23 manufacturers will present the appropriate data before the
24 product is cleared to market.

1 DR. GENCO: Further comments, questions?

2 (No response)

3 Thank you very much, Mr. Kennard. Next we will
4 have David Cochran, from Straumann USA.

5 **Presentation by Mr. Bill Ryan**

6 MR. RYAN: Before I introduce Dr. Cochran, I would
7 like to introduce myself. My name is Bill Ryan. I am the
8 President of Straumann USA, the U.S. subsidiary of Institute
9 Straumann. I am going to talk a little bit about the
10 company and then introduce Dr. Cochran.

11 (Slides)

12 You will notice that you have a package, and our
13 first slide on the package is now our third slide in the
14 presentation. Everything else you have in the package is
15 exactly as is.

16 Institute Straumann, the parent company of the
17 Straumann company and seller of the ITI dental implant
18 system, was founded in 1954 and introduced its first
19 orthopedic and maxillofacial implants in 1961, and moved
20 into the dental implant field in 1974.

21 (Slides)

22 The company is selling the ITI dental implant
23 system. We are one of the worldwide leaders, for sure. We
24 believe we are the second largest dental implant company in

1 the world. We have over 20 years of clinical experience,
2 history and research. In fact, that is what Dr. Cochran
3 will focus on during his part of the presentation. We have
4 sold substantially more than a million implants over this
5 20-plus year period. One demonstration of that is that we
6 have sold over 200,000 in the last year.

7 I would like then to introduce Dr. David Cochran,
8 Chairman of Periodontics at the University of Texas at San
9 Antonio, who is a Board-certified periodontist. He is a
10 Ph.D. in biochemistry. Without further ado, Dr. Cochran.

11 **Presentation by Dr. David Cochran**

12 DR. COCHRAN: Thank you, Mr. Ryan. As he
13 mentioned, I would like to talk about some of the work that
14 we have been involved in. We have been involved in both
15 basic and clinical research with the ITI dental implant
16 system, and the Straumann Company has supported this work.
17 They have also supported my trip here today, and I have done
18 teaching seminars for that company as well.

19 I would like to also mention that I use the ITI
20 dental implant system in my clinical practice, and I teach
21 this to the students in San Antonio at the dental school.

22 I would like to thank Dr. Genco and the rest of
23 the Panel, and the FDA members here today for this
24 opportunity to present some information about the ITI dental

1 implant system.

2 (Slide)

3 The ITI implant system, as Bill mentioned, has
4 been in clinical use for over 20 years now, since 1974, and
5 has had extensive documentation with over 200 peer-reviewed
6 publications. What this history and this documentation
7 presents is that this system is a very safe, predictable and
8 effective way to replace missing teeth.

9 (Slide)

10 Features of this implant system are that it has a
11 single-stage design, and on the nomenclature that we have
12 listened to this morning, this is referred to as a non-
13 submerged approach. When we talk about the single-stage or
14 non-submerged, we mean that at the time of implant placement
15 the implant extends through not only the bone tissue but
16 also through the soft tissues in the oral cavity. The
17 features include both solid and hollow implant designs, and
18 it is made of commercially pure titanium or CP titanium.
19 This is grade 4 titanium. It also has a titanium plasma-
20 sprayed surface, which comprises the endosseous portion of
21 the implant. Then coronal to that, the piece that goes
22 through the transgingival portion has a machined titanium
23 surface. The top of the implant also incorporates Morse
24 taper, which is a physical phenomenon which allows tight

1 apposition of all the abutments into the implant system.
2 Again, it is based on a lot of science and clinical
3 research.

4 We agree really with some of the former
5 presentations that the research that needs to be done needs
6 to be well documented, with very defined success criteria,
7 and analyzed as rigorously as can be.

8 (Slide)

9 The ITI implant system, as is sold since 1984,
10 really consists of two major designs. There is a
11 cylindrical implant and then there is a screw type implant.
12 Again, the endosseous portion of the implant has a TPS-
13 coated surface and then there is a machined surface that is
14 in apposition to the connective tissue and the epithelium.
15 What this does for the implant is eliminate a microgap or
16 connection at the osseous crest level, which is referred to
17 as the microgap right at the top of the bone surface.

18 Other features of these implants that you will
19 note is that on the cylindrical type implants there is a 15
20 degree angled implant, as well as the straight implant. The
21 advantage to the angled implant is that we know when you
22 lose teeth in the maxillary anterior the bone resorbs
23 posteriorally and apically, and so the angle, in order to
24 place an implant, needs to be at one angle and this allows

1 compensation of the resorption pattern of the maxilla and,
2 quite frankly, in my practice I don't know how I would do
3 without using this implant in those maxillary anterior
4 cases. So, this is one sort of unique feature of this
5 implant, but it is consistent with the rest of the implants
6 there.

7 This is also a press-fit implant, meaning that the
8 osteotomy site is prepared slightly less than the diameter
9 of the implant. So, when the implant is put in it has very
10 stable apposition against the bony walls. It also has
11 design features of what we call microretentive holes to
12 allow bony ingrowth into the apical portion of the hollow
13 portion of the implant.

14 On the screw type designs there is a standard
15 screw and then there is a reduced diameter and a larger
16 diameter, and this has the additional feature of a thread
17 design which allows for more primary stability at the time
18 of implant placement.

19 In the subsequent slides you are going to see
20 reference to these type of implants as HC or hollow
21 cylinder, and these will be SS or solid screw type designs.

22 (Slide)

23 The TPS surface is a surface that has been well
24 documented for a long time. What the TPS does for the

1 implant is that it provides additional surface area for the
2 attachment of bone. Different ways of measuring this
3 additional surface area indicates that there is around 10-
4 to 15-fold more surface area on the TPS-coated implant than
5 on a machined implant. This surface has been used, no
6 matter what the specific design of the implant is, for over
7 20 years, the same surface over the whole time.

8 Then there has been extensive in vitro testing on
9 the TPS, which you have a lot of information in your package
10 on.

11 (Slide)

12 One example of the advantage of the TPS on the
13 surface, and this is well documented in a number of studies
14 for probably over 20 years now, is the study by Silke, in
15 1990, which looked at torque removal values or, in other
16 words, how much force is required to remove an implant from
17 the bone. In this particular study a comparison was made
18 between the TPS screw implant versus a machined screw
19 implant. You can see that the TPS implant was about 10-fold
20 greater in newton centimeter forces required to remove the
21 implant than was the machined implant. So, this is one way
22 that you can measure the difference in the amount of implant
23 to bone contact. This is one of the functional assays.

24 (Slide)

1 If you look at the other studies, there is a whole
2 host of studies, over 20 years of studies to look at other
3 functional tests that defined how the surface
4 characteristics make a difference on the implant -- removal
5 torque, pull out strength, shear strength, as well as
6 histomorphometric descriptions of bone to implant contact.
7 So, there is a whole host of long-term data to support the
8 fact that you have some advantages to the TPS surface.

9 (Slide)

10 The in vitro testing that you have information on
11 includes static and fatigue testing, shear strength, a
12 number of surface analyses looking at the corrosion, the
13 composition and surface topography. But as a clinician,
14 probably the one thing that is most important to me is the
15 fatigue testing and how we can translate this to the in vivo
16 condition; what is going to happen when I place this in a
17 patient's mouth.

18 (Slide)

19 On this slide we show fracture rate analysis fro
20 clinical studies. The first comment I would like to make is
21 that with the standard solid screw implant, in a 10-year
22 period there have been no fractures reported in the use of
23 this type of implant. So, no fractures reported.

24 If we look at the hollow cylinder type implant and

1 the hollow screw, an earlier version of the hollow screw and
2 hollow cylinder implant, looking over a 5- to 8-year period
3 from a number of different investigators here, we see that
4 the fracture rate analysis is really quite low for even the
5 hollow implants. It has not been a problem as far as the
6 fracture rate goes.

7 If we compare the numbers or percentages that have
8 been reported in these studies to the study from Adell,
9 looking at a solid screw implant, we feel these numbers are
10 very similar or maybe even slightly better than some of the
11 other numbers reported for solid screw implants.

12 (Slide)

13 As far as the scientific support goes, there are
14 over 200 studies in peer-reviewed journals, and these papers
15 really discuss a number of issues about the implant system
16 as far as the materials, design of the implants, the
17 engineering behind it and the clinical success. Again, the
18 surface that has been used, although some of the design of
19 the implants has changed slightly over the years, has been
20 the same TPS surface since 1974.

21 The studies that have been involved with this
22 system cover all indications and locations, and all
23 different types of the implants that I have reviewed for
24 you. The result from this is that it is consistently a

1 predictable, with a very high success rate with the use of
2 this implant.

3 (Slide)

4 In the next series of slides I want to show you
5 some peer-reviewed studies, in this case from 1984 to 1991,
6 which really focus on a number of different countries and a
7 number of different centers. In this column we give you the
8 patients and the number of implants. You can see large
9 numbers of implants; the type of implant, like I mentioned
10 earlier, the hollow cylinder, the hollow screw and the solid
11 screw, and then an earlier version of the solid screw, the
12 TPS screw.

13 If you look at the follow-up time, you can see
14 long-term follow-up, and Dr. Babbush spoke to us a little
15 bit earlier, even 8-year data back in 1986 with a very high
16 percentage success rate according to defined criteria, and
17 success rates from 88% to about 97%.

18 (Slide)

19 If we look at studies that have been reported from
20 1991 to 1994, again, the hole array of hollow and solid
21 implants; a number of different investigators; 9.5 years, 5
22 years, and we see that the numbers for success rates in
23 these cases is around 95% to 99%.

24 (Slide)

1 If we look at peer-reviewed studies from 1995 to
2 1997, again, 9.5 years, 3 years, 97%, 99% and, again, very
3 high percent success rates for a number of different
4 indications with all the different types of implants and,
5 again, relatively large numbers of patients and implants.

6 (Slide)

7 As has been mentioned before, it takes a long time
8 sometimes to get the data together and published from
9 prospective clinical trials. The trials that were published
10 just in 1997, additional ones, show with longer-term follow-
11 up 9 years, 8 years, 7 years and 4 years, success rates,
12 again, above 93% using the different types of implants that
13 we have mentioned here.

14 (Slide)

15 The most recent published study is a prospective
16 clinical trial from three different centers. This has been
17 analyzed with life table analysis, including over 1000
18 patients, almost 2400 implants. This data has been reviewed
19 with the strictest criteria, up to 8 years, and it includes
20 both solid implants as well as hollow implants.

21 (Slide)

22 Just to look at this in a little more detail, the
23 criteria of success for this prospective study were absence
24 of pain, infection, mobility, radiolucency and mechanical

1 fracture of the implants. All the implants had to meet all
2 the criteria at each of the time points.

3 (Slide)

4 If you look at the life table analysis for these,
5 and focus on the 4-5 year, there were 502 implants in that
6 interval, 97% success rate; 5-6, 95%, down to years 7-8 and
7 there is over 93% success rate for the implant that has been
8 in place around 7-8 years. So, using the strictest criteria
9 that are available and a proper statistical analysis, we see
10 very high success rates.

11 (Slide)

12 If we break out from this data the different types
13 of implants, looking at a 7-year cumulative success rate,
14 for the solid implant it is about 97%; for the hollow screw,
15 about 96%; and for the hollow cylinder it is a little over
16 91%, keeping in mind that most of the hollow cylinder
17 implants were placed in the maxilla where the bone is a
18 little bit more cancellous and a little bit more tenuous to
19 place the implants in.

20 (Slide)

21 If we look at location, now looking at the data
22 from the 8-year cumulative success rate in the mandible
23 anterior list here, around 94% to 95%, and in the maxilla we
24 are looking at around 87%, 88%, 89% success rate by

1 anatomical location.

2 (Slide)

3 So, this long-term multicenter study, prospective
4 in nature, analyzed by life table analysis with strict
5 criteria of success indicates that the mandibular and
6 maxillary success rates compare favorably with the reported
7 Branemart success rates that are in the literature, as well
8 as other systems.

9 There are high success rates for both the hollow
10 and the solid implants, and these implants maintain this
11 high success rate over long-term follow-up.

12 (Slide)

13 Another way to look at implant performance over
14 time is to look at the amount of crestal bone resorption
15 that occurs, and the data from the previous study that we
16 just looked at is currently being analyzed for radiographic
17 evaluation. The preliminary results are presented here from
18 the three different centers. In the first year there is
19 less than a millimeter of bone loss, annual mean bone loss.
20 Then in the subsequent years, 2-5, there is about 0.5 mm to
21 0.1 mm of bone loss. So there are very minimal amounts of
22 crestal bone resorption around these implants over up to a
23 5-year time period.

24 (Slide)

1 The Straumann Company is committed to analyzing
2 their data and to continued research into this system, and
3 we have been very fortunate at the Health Science Center at
4 the University of Texas at San Antonio to be involved in a
5 5-year prospective clinical trial. We are into the second
6 year of that trial. There are a number of studies that are
7 ongoing that occur in both this country as well as the other
8 countries in Europe.

9 (Slide)

10 So, in conclusion, I think we can say that the ITI
11 dental implant system has a consistently high success rate
12 over all anatomical locations.

13 The safe and effective use of the ITI hollow and
14 solid titanium plasma-sprayed dental implants has been
15 confirmed by an extensive body of scientific literature.

16 The FDA has sufficient general and special
17 controls to provide reasonable assurance of safety and
18 efficacy.

19 Based upon this experience, both clinical and non-
20 clinical publications of the ITI dental implant system, it
21 is recommended that uncoated and titanium plasma-sprayed
22 root form titanium dental implants be reclassified as class
23 II devices.

24 I would like to just point out one point, and that

1 is the way this implant is placed, although it is placed in
2 a non-submerged approach so that it is exposed to the oral
3 cavity at the time of placement, there is still in the
4 standard protocol a waiting period of 3-4 months, depending
5 on the quality of the bone, before we load it -- just to
6 clarify the non-submerged as far as when the loading takes
7 place.

8 Thank you very much, and I would be glad to answer
9 questions

10 DR. GENCO: Thank you, Dr. Cochran. Are there any
11 questions from the Panel? Dr. Heffez?

12 DR. HEFFEZ: What is the distance between your
13 threads? I noticed on the photographs that the threads are
14 placed a little bit further apart I think than other implant
15 systems.

16 DR. COCHRAN: Yes. For instance, for the
17 Branemark I think it is 0.6 mm. Let me ask the engineers.
18 It is about twice that distance I think. The reason that
19 was designed that way is that the engineers designed that
20 based upon screw designs. As Mr. Ryan noted, this company
21 has been in the business of orthopedic screws and plates for
22 a long time with the Synthes system. Based upon the amount
23 of bone that can grow between the threads, it provides for
24 resistance to pull-out better if there is a wider distance

1 between the threads. That has been through a lot of
2 photoelastic studies as well so it has been extensively
3 characterized.

4 DR. HEFFEZ: So, clearly, through your studies
5 there is really no difference in the survival of the implant
6 but what is it if you were to compare -- and I don't want to
7 compare one company and another, you can select whichever
8 company you like -- is there a reduction in the amount of
9 surface area available for osseointegration based on the
10 increase in distance between your threads?

11 DR. COCHRAN: I think the question you are asking
12 is because the thread pitch is different between the two
13 systems, does that reduce the area for implant? My
14 understanding, and the engineers can back me up on this, is
15 that the comparisons are made when they look at the TPS
16 surface area to the machined surface area. Those are
17 similar designs and that is where you get a 10- to 15-fold
18 increase. The fact that the thread design is different, it
19 seems to me, is pretty negligible in light of those numbers,
20 and the engineers seem to back that up.

21 DR. PATTERS: Dr. Cochran, i wonder if you could
22 comment about whether there are sufficient differences
23 between the submerged and non-submerged systems to consider
24 them different types, or would you say that although the

1 system is designed to be non-submerged it could be
2 submerged, and vice versa, a system designed to be submerged
3 system could be used as non-submerged?

4 DR. COCHRAN: Right. That is an excellent
5 question. Clearly, there are attempts in the literature
6 now, or attempts by clinicians to use the submerged, or
7 traditionally submerged implants in a non-submerged
8 approach. We have done some research on this that is going
9 to be published in the November issue of The Journal of
10 Periodontology, which indicates in our research that if
11 there is a microgap at the bone level, and there is
12 literature to support the fact that there are bacteria that
13 contaminate that microgap, there is some resorption of the
14 bone at the alveolar crest due to the fact that there is a
15 microgap there, also due to the fact possibly that there is
16 movement between the abutment or the crown and the implant.
17 I think there are some relevant issues there. So I think a
18 system that uses a traditional submerged approach in a non-
19 submerged fashion is not the same as what I call a one-piece
20 non-submerged, and one piece means you eliminate that
21 microgap.

22 The other thing that there is some literature on
23 in the February issue of The Journal of Periodontology is
24 that if you look at the connection of the epithelium and

1 connective tissue around implants, if you have a one-piece
2 non-submerged implant that is very similar dimensions to
3 what is found around teeth in the classic work of Gargiulio.
4 So there are some real advantages to having a one-piece non-
5 submerged system.

6 DR. PATTERS: Do you believe the Panel should
7 consider them to be different types of implants, submerged
8 and non-submerged?

9 DR. COCHRAN: I think you have to acknowledge that
10 there are differences between the two situations. Now, is
11 that enough to constitute a different classification, I am
12 not convinced that that probably is the case.

13 DR. HEFFEZ: If the implant is not placed below
14 the crestal bone and the polished collar, regardless of the
15 manufacturer, if the polished collar remains above the
16 crestal bone, or is slightly above the crestal bone, how
17 does that differ from your implant system?

18 DR. COCHRAN: Well, in my view, it is a matter of
19 degree. If you leave it sticking up about a millimeter, in
20 my view, you are still going to get crestal bone resorption.
21 I think you have to leave it sticking up about 2 mm, which
22 is what the data supports. Now, if you have an implant that
23 is 2 mm up, then you essentially have something that is very
24 similar to this as long as there is no microgap below that

1 point.

2 DR. HEFFEZ: I have one other question. Many
3 times we say it is a one-stage surgery but in reality many
4 times we need to do other surgical procedures --

5 DR. COCHRAN: That is correct.

6 DR. HEFFEZ: -- and do you think a better term is
7 to call it a submerged and non-submerged technique rather
8 than a one-stage surgical procedure?

9 DR. COCHRAN: It is an excellent point. I don't
10 think there is a good answer on the terminology. Obviously,
11 there is a lot of confusion and, obviously, we see it on
12 your graph as well as when we try to write papers on this.
13 Even in the non-submerged approach, if you will, or the one-
14 stage approach there are times when we pull the tissue
15 partially over the ridge of the implant in esthetic areas so
16 we can make sure that we cover the margin between the crown
17 and the implant, and we do slight gingivectomy there. So,
18 like you point out, there are some minor modifications but
19 we distinguish that pretty differently from a traditional
20 second-stage surgery, where you reflect and expose the bone
21 tissue again. And we know that remodeling occurs when you
22 reflect the periosteum off the bone again, and that is kind
23 of different from the minor modifications that are done with
24 this one.

1 DR. MCCARTHY: Would you mind elaborating just a
2 little on the Morse taper which is, I think, unique with
3 your implant system as opposed to a screw-on type of
4 abutment connection?

5 DR. COCHRAN: Yes, I can comment and then the
6 engineers might want to. My understanding is that a Morse
7 taper means that you have two metal surfaces that converge
8 at 8 degrees or less between two metal surfaces. From a
9 dental perspective and a clinician's, I know when we polish
10 dentures, heaven forbid we have to do that, but if we have
11 the wheels on there we have to have those quick chucks to
12 release that, and that is because you have a Morse taper and
13 it holds it real tight. The people at the Straumann
14 Institute incorporated that same principle into the design
15 of the abutment into the implant so it is very much metal
16 locking, and so you get very little rotation of the
17 abutments out of the implants because it helps cushion the
18 forces as well, and takes most of the stress off the
19 threads. So, it is a unique design, and I noticed that some
20 other companies have tried to come somewhere to that but 8
21 degrees is the cutoff point for a true Morse taper, in my
22 estimation but, again, this is a purely engineering thing.

23 DR. STEPHENS: Have you had any reports of
24 separation of the TPS coating from the implant and, if so,

1 what sort of tissue reactions have you seen when this
2 happened?

3 DR. COCHRAN: Let me ask the company, but I think
4 they have a lot of data and I am sure you have it in your
5 package as far as any incidence of separation of the TPS
6 from the implant. It just doesn't occur. From my
7 understanding, you know, when you prepare it, you melt the
8 titanium particles and it is actually welded to the surface
9 so you just don't see the TPS coming off. I wouldn't expect
10 it to do anything because it is titanium oxide; you have
11 that oxide layer all around it. So, I don't anticipate that
12 as a problem even if it occurred. In the data that we
13 showed of some 20 years, I don't think it is a problem that
14 has come up.

15 DR. GENCO: David, I think you have some data here
16 that might be instructive to us in terms of the
17 subcategories. I would like to pursue the Buser '97 study
18 that you outlined so nicely here. It seemed to be a very
19 extensive study with almost 2400 implants in 1000 patients.

20 DR. COCHRAN: Right.

21 DR. GENCO: First of all, so understand a little
22 bit about the success criteria, lost-to-follow-up was
23 something like 5% of implants. Is there any indication of
24 why they were lost? Are those failures too, or some of

1 them? In other words, was there any analysis of the loss-
2 to-follow-up? I know that sounds like a strange question
3 but sometimes you can get some information on those loss-to-
4 follow-ups.

5 DR. COCHRAN: Right. The data was reported to you
6 in a pretty summarized form, but if you look in the
7 publication itself, I think he tells you how many people
8 moved from the area, and how many died. I think all those
9 details are in that data, but just with ten minutes we
10 couldn't go over it.

11 DR. GENCO: The criteria for success, there are
12 three terms: absence of persistent subjective complaints,
13 such as pain -- what does this mean? Does this mean
14 persistent for some months, days, weeks, years?

15 DR. COCHRAN: The way we defined that is if the
16 pain doesn't resolve in a reasonable period of time, which
17 means several weeks. As you know, if you do mandibular
18 overdenture, sometimes even though you are not right at the
19 nerve and you have that anterior loop, I think sometimes,
20 just from the osteotomy and the inflammation, you get a
21 little pressure on that but it goes away, and that is what
22 we mean.

23 DR. GENCO: In contrast to being right on the
24 nerve --

1 DR. COCHRAN: Or through it, yes.

2 DR. GENCO: Recurrent peri-implant infection or
3 suppuration, you accept one episode, treat it and if it
4 doesn't come back that means that this is not a failure?

5 DR. COCHRAN: Yes, recurrent in that definition
6 means if you can treat the infection and it goes away.

7 DR. GENCO: And then absence of continuing
8 radiolucency around the implant. Sometimes you see, as you
9 know, what looks like a peri-apical radiolucency, or on the
10 corner of the apical portion a little radiolucency. You
11 allow that, and not call it a failure in the absence of all
12 those other --

13 DR. COCHRAN: Exactly. Sometimes, you know, just
14 from the trabecular pattern of the bone you get some little
15 artifactual radiolucency periods, but with all these other
16 parameters we consider that not continual.

17 DR. GENCO: This is the point I am getting to, if
18 we go to understanding how the study was done, you have a 7-
19 year cumulative success rate for slid screw versus hollow
20 screw -- is there somebody who could put that slide back up?
21 For both the solid screw and the hollow screw you have about
22 95% or 96% success.

23 DR. COCHRAN: Right.

24 DR. GENCO: Then for the hollow cylinder, 91%. Is

1 that really different? I am not challenging your system --

2 DR. COCHRAN: No, no, I understand.

3 DR. GENCO: -- I am just saying is there a
4 justification for considering the hollow cylinder different
5 from the solid screw, for example, because that is being
6 presented to us as subgroup?

7 DR. COCHRAN: Right. I think what we are doing is
8 just presenting you the data as it exists. But then when
9 you talk about how this derived, and I made the comment
10 going through the presentation, most of these were in the
11 maxilla where there is more cancellous bone. The hollow
12 screws were predominantly placed in the posterior mandible.

13 The other thing you might want to consider, or if
14 you look at the numbers real closely, those hollow cylinders
15 -- there were less implants in the maxilla than there were
16 in the mandible.

17 DR. GENCO: So it is confounded by anatomic
18 position.

19 DR. COCHRAN: Yes, and numbers because, you know,
20 if you have a problem with one it is a higher percentage.
21 So I think those are probably pretty artificial differences.

22 DR. GENCO: So it is not a matter of the design of
23 the implant but maybe where they were placed, which was left
24 up to the clinician's judgment.

1 DR. COCHRAN: Right. This is a clinical study,
2 and you know all the ins and outs of that.

3 DR. GENCO: So, based upon that, we are not to
4 take the message that there is an intrinsic difference in
5 the success rates of hollow cylinders versus the other two
6 hollow screws and the solid screw.

7 DR. COCHRAN: Yes. I think the point really we
8 are trying to make is that each of these types of implants
9 has a very high success rate. Certainly, some of these
10 other factors are going to make some difference in these
11 numbers but, in general, I think you have to say that the
12 TPS-coated surface, if a clinician places it such that he
13 then jeopardizes the implant or overload it, as we heard
14 this morning, or any of those kind of things, you can feel
15 very confident that the implant itself is going to perform
16 very nicely.

17 DR. GENCO: So, you would argue against
18 subclassification of cylinders and screws?

19 DR. COCHRAN: I absolutely would.

20 DR. GENCO: Let's go to the next one, anatomic
21 position. That is really not on the FDA's chart but they do
22 have fresh extractions. Does this data give us any reason
23 to believe that the anatomic position of the implant should
24 be a consideration in the success rate or judging implant

1 types?

2 DR. COCHRAN: I am going to give you my opinion,
3 and my opinion is that, no, it is not. In all areas we are
4 dealing with alveolar bone. In some areas we deal with more
5 cancellous versus more cortical and, clearly, if you have
6 more cortical bone you are going to have a better healing
7 situation than you have with cancellous. I think we heard
8 some data earlier that when you deal with more cancellous
9 bone you have different considerations. I don't think from
10 a safety and efficacy point of view there is any difference
11 between those, but it is just that the clinician has to use
12 a judgment at some point as to what the best surface is to
13 use in an area where there is more cancellous bone or more
14 cortical bone.

15 DR. GENCO: So you would argue against labeling,
16 or whatever restriction to a particular anatomic area?

17 DR. COCHRAN: Yes, I would.

18 DR. GENCO: Based upon this data?

19 DR. COCHRAN: Yes.

20 DR. GENCO: You don't think that is real, that
21 difference between the mandible and the maxilla?

22 DR. COCHRAN: I think the difference is between
23 cancellous bone and cortical bone, but it is not just
24 because it is maxilla versus mandible. I think the data

1 supports that pretty clearly. All the animal models, as you
2 know, that have been done looking at bone to implant contact
3 is purely dependent on the type of bone that the animal
4 model has. Some are very cancellous bone and some are
5 cortical bone. Also, are you looking at a bone between the
6 threads? There are a lot of subtleties there, the three
7 best threads -- there are different ways to look at bone to
8 implant contact than completely around the periphery.

9 DR. GENCO: Thank you. Further comments or
10 questions from the Panel?

11 (No response)

12 Thank you very much. The next presentation will
13 be made by Dr. Richard Caudill, from Implant Innovations,
14 Inc.

15 **Presentation by Dr. Richard Caudill**

16 DR. CAUDILL: I would like to thank the Panel for
17 this opportunity to present the 3I data. I am a
18 periodontist, a Board-certified periodontist. I practice in
19 West Palm Beach, Florida. I am employed part-time by
20 Implant Innovations. I am paid for this trip.

21 I would like to report the data that we have for a
22 clinical trial. Personally, I began placing implants over
23 ten years ago, while teaching at the LSU School of
24 Dentistry, and I am experienced in the placement and

1 restoration of several implant systems, including 3I.

2 When I came to 3I, in 1992, I assisted them with
3 launching a preclinical and clinical trial of 3I's new
4 implant system. In that year, 3I launched a prospective,
5 multicenter study to address the requirements of a PMA.

6 What I would like to present today is an
7 integrated clinical and statistical report of 3I's ongoing
8 PMA clinical trial, which was supplied to the Panel members
9 in response to their request for data to support the
10 reclassification effort. I would like to briefly describe
11 the 3I study, its outcomes thus far, and how I think these
12 results impact on the process under discussion today.

13 The 3I study I will describe includes 3I's self-
14 tapping, threaded and TPS cylinder implants. A multicenter
15 study was implemented in 11 academic or private practice
16 clinics in the United States, Europe and Australia. Six
17 centers used threaded implants, three used cylinders, while
18 two used both. The enrollment of patients began on January
19 6, 1992 and involved 954 patients. That is, 584 with
20 mandibular implants. Of those, 43% were men and 57% women.
21 And 449 patients with implants in the maxilla, which were
22 44% men and 56% women. The mean age of all patients was
23 48.7 years. Altogether there were 2845 implants,
24 representing 1275 prostheses.

1 There were 12 prosthetic indications, including
2 single-tooth replacements, partially edentulous cases and
3 completely edentulous situations. The data presented today,
4 which the Panelists have, covers an interim analysis of 3I's
5 data received by October 24, 1996, with queried resolutions
6 through May 23, 1997.

7 The criteria for evaluation during the study
8 focused on implant function as assessed by periotest and
9 digital mobility. Therefore, lack of clinical mobility was
10 the primary criterion. Also, there would have been no
11 evidence of periapical radiolucency, absence of persistent
12 or irreversible signs and symptoms, such as pain, infection,
13 neuropathies, paresthesia, and violation of the mandibular
14 canal.

15 Secondary efficacy assessments included
16 radiographic evaluation of bone loss, peri-implant gingival
17 health and use of the Cornell Medical Index for assessments
18 of prosthesis retention and stability, occlusion, esthetics,
19 phonetics, patient satisfaction and the level of masticatory
20 comfort.

21 The data underwent a complete statistical
22 analysis, including life table and survival analysis
23 methods. The number and percentage of patients with adverse
24 dental and medical events were summarized overall, and by

1 implant location and type.

2 The efficacy results: of the 2845 implants placed,
3 96 failed in the first 3 years of the study. Of these, 74
4 failed in the first year after stage-one surgery. The
5 overall implant success rate was 96.7% at 1 year after
6 stage-one surgery, and 93% after 3 years. By implant
7 location, the 2-year success rate was 96.3% for mandibular
8 implants and 93.4% for maxillary implants. By implant type,
9 the 2-year success rate was 98.5% for cylinders and 94% for
10 threaded implants.

11 Regarding safety, a total of 193 patients, or 20%
12 of the total, reported an adverse event, including surgical
13 complications not affecting osseointegration -- these are
14 dental adverse events; loss of implant integration in 48
15 patients; fistulas in 2%; and other bone and soft tissue
16 complications in 3% and 2% respectively.

17 Regarding components, abutment fractures were
18 noted on 2 mandibular cylinders, and abutment screw
19 fractures on 1 implant, 0.2% total, and 1 implant experience
20 prosthetic screw fracture, 0.2% of the total.

21 The conclusions from these data of the controlled
22 clinical studies of the 3I TPS cylinder and self-tapping
23 threaded implant systems showed them to be safe and
24 effective. No medical events have been experienced to date

1 to indicate biocompatibility problems.

2 The questions I would like to air revisit some of
3 the questions that you stated on your handout and some of
4 our own. First of all, your first question, as we consider
5 down-classification of endosseous implants, should we
6 consider implant location in the oral cavity as a component
7 of the device's indication for use?

8 We think the data that we submitted, at least as
9 far as categorizing maxilla and mandible, if that is fair to
10 do, shows adequate performance of the 3I implant systems
11 across the prosthetic indications and anatomic locations we
12 studied. We feel that the ultimate decision of anatomic
13 location and implant acceptance should be based on the
14 data's own merit.

15 Secondly, we do support the classification of
16 implant accessories to follow acceptance of the associated
17 implant systems. In our study, we stacked up the components
18 and we included those components, obviously, with the
19 implant systems, and the data is reported as such.

20 Finally, Panel members, although today's
21 presentations appear to support reclassification, we would
22 encourage the Panel to require adequate clinical research
23 data to substantiate acceptance of current and future
24 implant designs. Thank you.

1 DR. GENCO: Thank you. Any comments or questions
2 from the Panel?

3 With respect to hollow versus solid, you also
4 analyzed that?

5 DR. CAUDILL: No, ours are solid implants.

6 DR. GENCO: Oh, I see. You have cylindrical.

7 DR. CAUDILL: Yes. Any other questions?

8 (No response)

9 Thank you.

10 DR. GENCO: Thank you very much. The last speaker
11 is Dr. Kenneth Burrell, from the American Dental
12 Association. Ken?

13 **Presentation by Dr. Kenneth Burrell**

14 DR. BURRELL: Thank you, Mr. Chairman. I am
15 Kenneth Burrell. I am Senior Director of the American
16 Dental Association's Council on Scientific Affairs. I have
17 no financial interest with any dental products in this
18 category.

19 The reason I want to speak before you is to invite
20 you to use the vast amount of information that the Council
21 on Scientific Affairs has been able to accumulate through
22 the years on dental implants. You will notice in the packet
23 that was sent to you that you have a copy of our guidelines
24 for evaluating these kinds of products. You have our report

1 to the profession, which appeared in a 1996 issue of The
2 Journal of the American Dental Association , and you also
3 have our list of accepted products.

4 My brief statement is to provide to you evidence
5 of why you should consider that material that I provided
6 you. In establishing guidelines for evaluation of
7 endosseous implants, our major concern was in the design of
8 clinical trials and the degree of specificity required in
9 the final data.

10 There had been discussion regarding the
11 possibility of creating several categories for implants,
12 dependent on the area of placement, the number of implants
13 placed and the design of the final prosthesis. But such
14 subgrouping would likely create more problems than it would
15 solve, not to mention that it would result in the need for a
16 huge number of clinical trials with a large patient
17 population.

18 Instead, we opted for a more practical approach,
19 which meant defining the study population so that the
20 majority of subject patients would have implants placed in
21 less favorable locations. If clinical success could be
22 established in these sites, it could be extrapolated to more
23 favorable locations with relative predictability.

24 The model for clinical studies requires a minimum

1 of 50 patients in each of 2 independent studies, although
2 other configurations involving up to 5 sites, with a total
3 population of at least 100, can be acceptable with
4 appropriate scientific methodology. Subject populations
5 should be representative of the populations seeking
6 implants, and a minimum of 60% of the patients in the study
7 should receive either single-tooth replacement or short-span
8 fixed partial dentures of 3 units or less placed in the
9 posterior region of the mouth where occlusal forces are
10 greatest.

11 In seeking ADA acceptance, implants are evaluated
12 at regular intervals for a 5-year period, with the date the
13 implant is loaded as the starting point. For products
14 applying for provisional acceptance, 3-year data may be used
15 to gain interim use of an ADA statement while the longer
16 clinical trials are still under way. Provisionally accepted
17 products are reviewed annually for up to 3 years. After 3
18 years, the product must meet the guidelines for full
19 acceptance or it is removed from the provisional acceptance
20 list.

21 Protocols for clinical studies must delineate in
22 detail the criteria for patient selection or exclusion; the
23 techniques used for placement and restoration; the criteria
24 assessed and the methodology employed, and the statistical

1 handling of the data. In addition, radiographs must be
2 available upon request. Overall success rates must exceed
3 85% for an implant to gain acceptance under the ADA program.

4 In addition to the information on the implant per
5 se, manufacturers must describe the restorative components
6 used in clinical trials, although acceptance is issued only
7 to the implant and the placement technique. It would be
8 impossible to evaluate the myriad combinations of implant
9 and restorative products available. So, we have to assume
10 that in most cases compatible components will be utilized.

11 Implants and their connecting components are being
12 developed at an incredibly rapid pace, but many of the newly
13 introduced products are based on proven designs and
14 materials. When only minor variations exist between implant
15 systems, the company can petition for acceptance of similar
16 products, and the Council can accept, deny or request
17 modification of documentation. For implants that are
18 significantly different from one another, however, we
19 require separate clinical trials. Factors that constitute
20 significant differences include variations in composition;
21 whether the implant is coated or non-coated; changes in
22 placement technique or loading; and design differences that
23 require a change in placement, instrumentation or procedure.

24 Although the number of implant products meeting

1 ADA acceptance criteria continues to grow, differences in
2 design, materials, surface finish, surface coating,
3 porosity, surgical technique, implant reconstruction, and an
4 array of other factors influence clinical performance. In
5 addition, lack of standardization between implant
6 manufacturers has created some confusion concerning
7 placement, restoration and maintenance of endosseous
8 implants.

9 Material standards for dental implants are in the
10 works at both national and international levels. Once
11 completed, these standards may lessen the need for clinical
12 trials for some products. Until these standards are in
13 place, however, each implant system must be evaluated
14 independently to ensure its safety and effectiveness. Thank
15 you.

16 DR. GENCO: Thank you. Comments or questions from
17 the Panel?

18 It sounds like you have taken a position of not
19 subgrouping but requiring clinical studies for implants that
20 vary from some common feature design?

21 DR. BURRELL: Right, we try to group implants into
22 larger categories, and I think this was brought up by some
23 manufacturers earlier in the day.

24 DR. GENCO: What are these?

1 DR. BURRELL: Well, for instance, if there is
2 similarity in design then you might be able to extrapolate
3 that kind of information; a common surface area on the
4 implant in the area that is being integrated.

5 DR. GENCO: But you have not subgrouped them
6 initially. You have looked at what has come in --

7 DR. BURRELL: Well, what the Council does is they
8 will evaluate each system as it is submitted, and based on
9 previous experience and the body of literature, we will then
10 determine the group or whether it needs to be subgrouped.

11 DR. GENCO: I guess our process is different
12 because we really have to classify and if certain things are
13 classified certain ways then, essentially, little or no data
14 has to come --

15 DR. BURRELL: Right. What we are saying is that
16 each type of implant has to be evaluated on its own, but I
17 think that there are also some common properties that one
18 implant shares with others. So, it is not a clear-cut,
19 clean thing that we would deal with here.

20 DR. GENCO: Comments or questions?

21 DR. HEFFEZ: I would go along a little bit further
22 with that. To reiterate, I guess the question, what
23 groupings have you selected? What common points are there
24 that force you into certain groups? What are the names of

1 the groups?

2 DR. BURRELL: Well, it is very interesting, we do
3 this in a slightly different way. We will write guidelines
4 and we will say to the world that if you can meet these
5 criteria using clinical studies and biocompatibility tests,
6 your product is effective, and if you have a high success
7 rate within five years with two clinical studies, then you
8 are awarded the seal. So, we don't set up the categories to
9 begin with. There are various types of implants that are
10 accepted now. We have blades and we have root-shaped
11 implants.

12 DR. HEFFEZ: So, essentially you have selected
13 certain criteria for success --

14 DR. BURRELL: Yes.

15 DR. HEFFEZ: -- and these products have to meet
16 the criteria.

17 DR. BURRELL: Right.

18 DR. HEFFEZ: So, really you only have one group.

19 DR. BURRELL: Right.

20 DR. HEFFEZ: There are no subgroups.

21 DR. BURRELL: Right.

22 DR. GENCO: So that means that any company would
23 have to come in individually with a set of studies. They
24 couldn't just argue comparability.

1 DR. BURRELL: At this point, no.

2 DR. GENCO: In other words, if another company
3 came in with a blade or another company came in with
4 whatever, if it is a "me too" you don't have a mechanism for
5 saying, well, we already saw the data on something that is
6 virtually the same, therefore, you don't have to submit
7 studies.

8 DR. BURRELL: Well, at this point, no. But I
9 think that the Council would consider evaluating a product,
10 if they were able to convince the Council that this product
11 is similar to an already accepted product, if those data are
12 already in the literature.

13 DR. GENCO: So it is really a substantially
14 different process.

15 DR. BURRELL: Yes.

16 DR. GENCO: Thank you very much.

17 DR. BURRELL: Thank you.

18 DR. GENCO: Comments, questions?

19 MR. LARSON: I have a question. I am interested
20 in your comments about standards and their effect on your
21 process. I realize that is your process but also it will be
22 relevant to our process. What would you consider to be the
23 material standards that would be necessary? I realize you
24 can't be comprehensive but can you give us some perspective

1 as to what would be necessary to lessen the need for
2 clinical trials?

3 DR. BURRELL: Well, as I understand it, the
4 process is in its early stage, and I don't pretend to be an
5 expert in this area so I can't tell you what characteristics
6 I would look for in establishing that; what features would
7 be necessary to meet the standard. But it would seem to me,
8 however, that if the body of literature shows that certain
9 implant designs using certain materials have a long track
10 record of success, then those features would be built into
11 the standard.

12 MR. LARSON: I was alluding to TC 106 --

13 DR. BURRELL: Right.

14 MR. LARSON: -- where we are developing standards
15 but it is not a comprehensive approach directly toward
16 meeting those specific requirements.

17 DR. BURRELL: Sure.

18 DR. GENCO: Further comments or questions?

19 (No response)

20 Thank you very much.

21 DR. BURRELL: Thank you, Mr. Chairman.

22 DR. REKOW: Mr. Chairman, I have a general
23 question for anyone that would like to answer it. Of the
24 patients that come in to a practice that are completely

1 edentulous, how many cannot have implants? What portion of
2 the population can't be served by implants? Then I have a
3 similar question, what portion of patients can't have a
4 single implant? Does anyone have any idea about that?

5 DR. GENCO: Dr. Weiss, do you want to comment?

6 DR. REKOW: Answer it both ways please, Dr. Weiss,
7 because I know what you are going to tell me partly.

8 DR. WEISS: Do you want me to sit down?

9 (Laughter)

10 DR. REKOW: No, no, no. Tell me part of the
11 answer if it was the root form and then also if it were the
12 blade form that was considered.

13 DR. WEISS: Well, when I spoke I mentioned
14 multiple modalities. Such modalities as the periosteal
15 implant and transosseous and others have been particularly
16 formed to take care of these severely atrophied patients.

17 DR. REKOW: So what percentage is that?

18 DR. WEISS: There are about 20 million people who
19 are totally edentulous in the United States, to the best
20 figures that I can find. I would say that about 20% of them
21 have lost so much bone that without major augmentation
22 procedures they would be unable to be served, and they could
23 be served almost immediately with something called a ramus
24 frame implant, or subperiosteal implant, or certain types of

1 transosseous implants.

2 I went to the American Museum of Natural History
3 years ago and found out that if I was going to assume a
4 cylinder of 4 mm diameter and wanted to set up criteria for
5 1 mm of bone on each side after the implant is placed, about
6 20% of the healed edentulous alveolar ridges could receive
7 such an implant and 80% could not because of the narrowness
8 of the ridge and certain landmark areas such as sinuses,
9 inferior alveolar nerves etc., there would be insufficient
10 depth. That is why it is so important that the multi-
11 modality concept is understood by everyone because it very
12 importantly expands the scope of treatment and, even more
13 importantly, expands the scope of treatment for our most
14 troubled patients. Was that helpful?

15 DR. REKOW: Yes. Is that 20 million people in the
16 United States or in the world?

17 DR. WEISS: Sorry?

18 DR. REKOW: Is it 20 million people in the United
19 States?

20 DR. WEISS: The number I received was in the
21 United States. Then there was another question asked and I
22 raised my hand because I thought it might be helpful -- I
23 have struggled with it for years, and that is the
24 nomenclature question that had to do with submerged, semi-

1 submerged, one-stage and two-stage. I would suggest that you
2 thing about this, that an implant that is a two-stage
3 implant, which means that the abutment mechanism is attached
4 after healing, can either be placed submerged, which means
5 that it is covered with mucosa on the day of placement, or
6 it can be placed semi-submerged, which means that you don't
7 need the second surgery to expose it but it is still not in
8 function; it is pretty flush with the tissue. So,
9 therefore, we would say that an implant can be one-stage,
10 which means that it is one solid piece of metal including
11 the abutment head with nothing that needs to be attached, or
12 two-stage, in which case it can be placed submerged or semi-
13 submerged but the second stage would be to place the
14 abutment mechanism.

15 **Open Committee Discussion**

16 DR. GENCO: If there are no other questions or
17 comments, what I would like to propose is that we go for
18 about 15 minutes discussing the questions and considerations
19 the FDA has posed to us, take a short break and come back
20 for about another hour. At 3:40 we have to have an open
21 public hearing on sleep apnea. So, we have essentially
22 reserved this afternoon approximately an hour and a half for
23 discussion of these questions and considerations.

24 So, what I would like to do is ask the Panel to

1 look at question two, based on the information reviewed by
2 the Panel, what implant types may be grouped together for
3 the purposes of reclassification?

4 This really follows from the extreme position, or
5 a position presented by the ADA where there is no
6 subclassification to the other extreme the FDA has presented
7 us with something like eleven or so. So, what are your
8 feelings with respect to the grid presented to us by the
9 staff of the FDA in terms of subclassification? Does
10 somebody want to start? Yes, Mark?

11 DR. PATTERS: Well, as I review the ADA's
12 classification and review the information presented today, i
13 get the overall impression that implants, at least root-form
14 implants placed in the mandible are successful slightly over
15 90% of the time, and those placed in the maxilla are
16 successful perhaps 90% or slightly less than 90% of the
17 time. It doesn't appear, from the data that I have seen,
18 that there is a significant difference whether they are
19 coated or uncoated, whether screws or cylinders, or how the
20 coating is prepared. The success rates appear to be quite
21 the same, and there is certainly no evidence of them being
22 statistically different in any way.

23 However, I would be concerned that there
24 additional factors in coated implants, such as how the

1 coating is prepared and how well it adheres, that would
2 probably have to be considered in a generic classification.
3 So, part of me feels like there doesn't appear to be any
4 difference in the usefulness or the success rate of the
5 implants regardless of how they are characterized. On the
6 other hand, I am somewhat concerned that certainly coated
7 implants would need to be classified in such a way that one
8 could guarantee the safety and efficacy of the coating.

9 DR. GENCO: Are you saying that among endosseous
10 dental implants one group is root form, and a subgrouping of
11 root form, solid root form, hollow, is not necessary but
12 there should be subgroupings of root forms with respect to
13 surface coating?

14 DR. PATTERS: I think there has to be a standard
15 for coatings. If that is not considered to be a
16 subgrouping, then I don't see how the FDA would be able to
17 write such a standard. So, yes, that is what I am saying.

18 DR. GENCO: Further discussion of that point?
19 What I am hearing is that for endosseous dental implants one
20 subgroup is root form, and it is not subdivided, but that
21 there be standards for range of coatings possible. Is that
22 what you are saying? All the way from machined to porous?

23 DR. PATTERS: Well, I think there is clear
24 evidence that there are well made coatings and there are not

1 well made coatings. I think that is clear from the
2 literature. FDA would need a mechanism for controlling
3 that.

4 DR. GENCO: But what we are trying to come up with
5 is generic groupings for devices which would allow us to
6 recommend to the FDA that such a grouping is class I, II or
7 III. Now, if it is class II or even class I, it will have
8 some specifications and standards -- might have standards.
9 So, you are not saying subgroup the root form into various
10 types of coatings?

11 DR. PATTERS: No.

12 DR. GENCO: You are just saying make standards for
13 the quality of the coatings?

14 DR. PATTERS: Yes.

15 DR. GENCO: Further comments on that? Does
16 everybody agree with that? We have already collapsed about
17 ten of these subgroups into one. Susan, what do you feel?

18 DR. RUNNER: I just want to clarify. You are
19 saying that you want just one grouping, root form, and then
20 the subgroupings would just be the coatings?

21 DR. GENCO: No, to get the discussion going, the
22 suggestion is that endosseous dental implants have at least
23 one subgroup, and that be root form.

24 DR. RUNNER: Okay.

1 DR. GENCO: And that is it so far, and that the
2 coatings be part of the specifications or standards, that if
3 the coatings are such-and-such, they have such-and-such
4 quality characteristics; if they are such-and-such, they
5 have such-and-such characteristics. Does that make sense?
6 Does that help?

7 DR. RUNNER: Yes, but that means that no one has
8 any concerns about the differences between the coatings in
9 terms of their safety and efficacy. I want to make that
10 clear. Is that what you are saying?

11 DR. GENCO: If we recommended to you a subgrouping
12 with respect to coatings, then the generic type would be
13 endosseous implants, subgroup 1, group form; subgroup 1A,
14 coated one way; subgroup 1B, coated another way. Mark,
15 would that help?

16 DR. PATTERS: I am not sure I follow Dr. Runner's
17 concern that if we do it the way you originally stated it
18 shows no concern for the quality or safety and efficacy of
19 the coating. I think it does. I am not sure that that
20 concern differs whether the coating is ceramic or metallic.

21 DR. RUNNER: I am not concerned that you are
22 lumping them. I just want to be clear as to what you are
23 saying for us to consider the classification.

24 DR. GENCO: Is what you are saying that you feel

1 from what you have heard and what you have read that, no
2 matter what the coating is, among those coatings we have
3 heard about -- I mean, obviously somebody could put
4 something else on it that didn't work at all, but among
5 those coatings that we have heard about, including grit-
6 blasted, machined, porous ceramic, and hydroxylapatite and
7 the metallic porous, you don't see any difference in
8 efficacy as long as each one of them is made according to
9 the way the manufacturers have told us they have made.

10 DR. PATTERS: I certainly see no evidence for any
11 statistically significant difference in efficacy, and
12 certainly no evidence for any clinical difference. As I
13 said, slightly higher than 90% for the mandible, perhaps 90%
14 or slightly lower for the maxilla regardless what coating it
15 was or whether there was a coating. If there is data to the
16 contrary, I would certainly like it to be shared.

17 DR. GENCO: Do you want to comment on that?

18 DR. DRUMMOND: I guess I would like clarification.
19 Are there differences between the ceramic versus metal
20 coatings in terms of attachment? Is that data available?

21 DR. REKOW: Does it matter?

22 DR. DRUMMOND: Well, that is what we are trying to
23 figure out, does it matter in terms of clinical results. I
24 mean, there are differences in the material properties --

1 DR. REKOW: Of course.

2 DR. DRUMMOND: I can figure that out. In terms of
3 clinical success, does it seem to matter in terms of whether
4 it is coated versus whether it is not coated?

5 DR. HEFFEZ: Obviously we are early in the implant
6 history, and you can see that in 1991 it was classified as
7 class III for most implants, except for mandibular implants.
8 So, you can see how we have grown up to this point in time.
9 Now we are placing a lot of implants. We have become more
10 sophisticated but, I promise you, five years from now much
11 of what we have said today we will probably be ashamed that
12 we said it.

13 I think that what might be important is to realize
14 that you are placing the implant but we have to deal with
15 the implant failures, that we are placing now, 10 years,
16 maybe 15 years from now, and maybe there will be some
17 importance in how we look at these implants, and it may be
18 important that one is porous ceramic, one is porous
19 metallic, and the management may be different.

20 So, I think since we are still early in the
21 history of this implant business, it is better to be a
22 splitter than a lump, and when we become more
23 sophisticated we can lump.

24 DR. GENCO: Could you make some suggestions in

1 terms -- first of all, do you agree with the root form as
2 one subgroup? Then, under that, you are suggesting several
3 subgroups in that subgroup based upon coatings?

4 DR. HEFFEZ: Yes.

5 DR. GENCO: Okay. What would those be? Maybe you
6 can't come up with all of them right now but we can discuss
7 it. Just put some on the table for discussion.

8 DR. HEFFEZ: Well, we have discussed whether
9 things are porous or non-porous. Each of those porous, non-
10 porous categories can be further separated into whether it
11 is a screw or cylinder.

12 DR. GENCO: Oh, you would like to retain the screw
13 versus cylinder?

14 DR. HEFFEZ: Yes, I think that we are too early in
15 the history. I don't think we should separate them right
16 now.

17 DR. GENCO: So, you are suggesting root form
18 porous and non-porous as two subgroups, and then for each
19 group a screw and a cylinder. Hollow cylinder or solid
20 cylinder? Doesn't matter?

21 DR. HEFFEZ: Well, you are asking me to give an
22 opinion immediately --

23 DR. GENCO: No, no, I am just saying put something
24 on the table for discussion.

1 DR. HEFFEZ: Basically, I feel that there are a
2 lot of different implants out there and there are many
3 implant companies, and products are coming out all the time,
4 and I think we have to see how the chips fall later on. So
5 I think, yes, we should separate it out into whether it is
6 hollow or not.

7 DR. GENCO: So, further subdivide cylinder into
8 hollow or solid. Okay. Any discussion of that? We have on
9 the table a subcategorization which looks more and more like
10 what the FDA originally proposed to us. There is root form,
11 porous, non-porous; and then either screw or cylinder; and
12 then the cylinder would be hollow or solid. Yes?

13 MR. LARSON: I think maybe some of these
14 distinctions are not significant to the clinical outcome,
15 but there is just one, almost procedural thing, which is if
16 we ended up lumping them completely together you could end
17 up with such things as machined cylinders or grit-blasted
18 cylinders, which would not be appropriate from the
19 standpoint of not having any retention features at all. So,
20 obviously, grit-blasted and machined are appropriate to
21 screws but are not necessarily appropriate to cylinders
22 without any other features. But, other than that, I would
23 be in favor of grouping rather than splitting as much as
24 possible.

1 DR. GENCO: So, you are against this proposal.

2 (Laughter)

3 MR. LARSON: Well, as the industry rep. I don't
4 have a vote but, yes, I think we have seen clinical data
5 that shows that the distinctions are not very great, if
6 there are any at all. So, therefore, I would be in favor of
7 grouping for the most part, except for these little things
8 that could slip in by mistake if we are not careful about
9 it.

10 DR. GENCO: So, you are proposing then root form
11 and --

12 MR. LARSON: I guess in order to avoid machined
13 cylinders, you just about have to then separate cylinders
14 and threads. So, you can put a variety of surfaces on
15 threads and you can put another variety of surfaces on
16 cylinders.

17 DR. GENCO: So, under root form would be screw and
18 cylinder; and under cylinder you would only have -- what?
19 Non-machined?

20 MR. LARSON: No, you would have TPS-coated, HA-
21 coated.

22 DR. GENCO: Coated?

23 MR. LARSON: Yes.

24 DR. GENCO: Cylinders coated?

1 MR. LARSON: There might be some other surfaces
2 that might be appropriate in the future but I don't think we
3 would ever want to see just a straight machined.

4 DR. GENCO: Right. Cylinders coated; then under
5 screw, porous and non-porous?

6 MR. LARSON: Yes.

7 DR. GENCO: It would get you to about the same
8 place. It is a modification.

9 MR. LARSON: It is not too far different, but I
10 wouldn't make as much distinction between the various kinds
11 of surface treatments.

12 DR. GENCO: So, the proposal now is -- and I don't
13 think it is too much different from what we said, for
14 endosseous dental implants one subgroup is root forms, and
15 root forms are further divided into screws and cylinders.
16 The screw can be porous or non-porous and the cylinders
17 porous as a group.

18 MR. LARSON: Surface treated in some way.

19 DR. GENCO: Surface treated porous. Okay.
20 Cylinders coated or surface treated.

21 DR. DRUMMOND: If you are going to put a coating
22 on there you have another interface, and I would be
23 concerned down the road how you are going to treat the
24 surface. If you put another interface in there, there is

1 always potential for more problems, the more interfaces you
2 have. So, I would differentiate between the interface in
3 terms of how the coating is applied. Grit-blasting would not
4 be the same to me as a coating.

5 DR. GENCO: So, surface treated covers both?

6 DR. DRUMMOND: I would differentiate between
7 surface treated versus coated or uncoated. You could have
8 no surface treatment, or you could have surface treatment in
9 terms of grit-blasting; you could have a coated versus an
10 uncoated. I would be more concerned with the interface than
11 the surface treatment in terms of potentials down the road.

12 DR. HEFFEZ: Surface treatment could be not only
13 grit-blasting but chemically --

14 DR. DRUMMOND: Yes, it could be a lot of things
15 that we are not talking about now.

16 MR. LARSON: I guess the only one that I would
17 want to exclude from the cylinder would be the straight
18 machined, no retentive features. Obviously, that is not
19 appropriate. We don't really know how that is finally going
20 to be divided.

21 DR. GENCO: All right, let's leave that for a
22 minute. Are there any other types besides root form that
23 would be major subgroups? In other words, we have
24 endosseous to distinguish from subperiosteal and other

1 types. Now, under the endosseous we have root form. Is
2 there another?

3 DR. PATTERS: Blades obviously.

4 DR. GENCO: I heard blade.

5 DR. PATTERS: Blade.

6 DR. GENCO: Do you want blade as a major subgroup?

7 What are your feelings?

8 DR. HEFFEZ: I believe blade is an endosseous
9 implant.

10 DR. GENCO: Right. So it is another subgroup.
11 So, we have root form and blade. Is there any subgrouping
12 under blade?

13 DR. PATTERS: Coated and non-coated.

14 DR. HEFFEZ: By calling them coated and non-
15 coated, that is not synonymous to porous and non-porous.
16 Porous and non-porous are more all-encompassing in terms
17 that they can include coating or surface treatment. But
18 just coated and non-coated eliminates the ability to talk
19 about surface treatment.

20 DR. GENCO: Yes, and I guess the FDA has already
21 dealt with that. The CFR defines porous metallic coated in
22 a certain way. We could stick with that. The alternative
23 is non-porous. So those would be the two distinctions then,
24 porous and non-porous, and there is a definition of that.

1 DR. HEFFEZ: I am just saying in the hierarchy of
2 things we can talk about screw and cylinder, high hierarchy,
3 and that is equal to porous and non-porous because those are
4 all-encompassing terms. But when you come down to coating
5 you are narrowing and you are not including everything.

6 DR. PATTERS: Bob, I would again like to argue for
7 simplicity here. I think the literature shows us that there
8 are some obvious reasons to be concerned about the interface
9 between the coating and the implant. There are very solid
10 reasons for considering classifying those as coated
11 separately from non-coated. But performance standards, as I
12 understand it, can cover the issues of retention so that one
13 does not have to, by classification, eliminate a machined
14 cylinder. The performance standards can say the implant has
15 to have some degree of retention under certain conditions.
16 I don't believe it is necessary to make a separate
17 classification to eliminate some possibility.

18 So, I would argue to simplify. I have just not
19 heard a strong argument that cylinders and screws are very
20 different. Quite clearly, the literature tells us that the
21 coating may be important, especially if it is not properly
22 applied and not properly manufactured.

23 I think that blades are very different than root
24 form implants in the procedures for placement, etc. So

1 those are the only bases that I see for subcategories --
2 blades from root form and coated from non-coated.

3 DR. GENCO: So, what you are saying is that the
4 two major classifications would be root form and blade, and
5 then under each would be porous and non-porous.

6 DR. PATTERS: No, coated and non-coated. Coating
7 is applying some other material to the implant. Porous, you
8 can make it porous by sandblasting it but it is the same
9 material. Is that not correct?

10 DR. GENCO: I am confused about that -- no, I am
11 not confused about that but I think that there are several
12 things going on here. You can make it porous by coating it
13 or you can make it porous other ways. You made a point
14 about that.

15 DR. PATTERS: I share Dr. Drummond's concern about
16 the relationship between the coating and the implant, and I
17 don't want that to be lost. That is a major concern I have.

18 MR. LARSON: But, as you said, that can be handled
19 with the standards without making a separate classification,
20 by just saying if it is coated, the coating shall meet these
21 requirements. Would that not be acceptable?

22 DR. GENCO: I go back to this issue of porous and
23 non-porous because I think the FDA has already dealt with
24 that issue. Susan, can you give us some direction here?

1 DR. RUNNER: Angela, could you come up to the
2 microphone and explain the separation of the different
3 types, please?

4 DR. GENCO: So, to reiterate what is on the table
5 right now, there are two major categories, root form and
6 blade, and we are talking about the terminology to look at
7 the surface, whether it be porous, non-porous, or coated,
8 non-coated, or a combination of the two or neither.

9 MS. BLACKWELL: Both porous and non-porous, the
10 way they were originally put on this grid, they were coated.
11 There are two different groups of coating. Grit-blasted or
12 machined is they are not coated. With grit-blasted you also
13 end up with something that is roughened but I wouldn't
14 really consider it porous. So if you are going to group it
15 into two groupings, you need coated and uncoated.

16 DR. GENCO: Let me see if I understand. You are
17 suggesting coated and uncoated. Then if we want to further
18 subdivide them, coated would be porous and non-porous.

19 MS. BLACKWELL: Yes, sir.

20 DR. GENCO: Okay.

21 DR. REKOW: Are we only talking about existing
22 implants?

23 DR. GENCO: We are coming up with a generic
24 classification which covers what is existing, as I

1 understand it. Susan, is that true?

2 DR. RUNNER: That is correct. If there was a new
3 coating that was to come into FDA, they would have to claim
4 equivalence and go from ground zero to prove equivalence.

5 DR. REKOW: Well, suppose I could make
6 stereolithography work so I could have a porous metal that I
7 could create?

8 DR. RUNNER: I think that would still be
9 substantially different enough from previously cleared
10 implants that it would require additional data, but it could
11 still be handled under existing regulation.

12 MR. LARSON: But, for instance, if you could
13 demonstrate by coarse stereology that you were substantially
14 equivalent to the porous bead-coated, that might be a basis
15 for establishing that.

16 DR. RUNNER: Sure.

17 DR. REKOW: I don't think you should just
18 arbitrarily throw out uncoated porous.

19 MR. LARSON: I guess I would be concerned about
20 the porous, non-porous designation and wonder what about
21 thinking about the claims in terms of tissue ingrowth more
22 than porous versus non-porous.

23 DR. RUNNER: But at this particular time we are
24 classifying what we have. If there is something that is

1 totally different -- we are not going to be able to think of
2 every single type of coating or new metal that would come
3 into being. Therefore, they would have to prove substantial
4 equivalence. We don't have to have an exact classification
5 here. There is some play for technology creep.

6 DR. GENCO: So, what I am hearing is that we have
7 to deal with what has already been presented to the FDA, and
8 you have already gone through that in coming up with your
9 suggestion here. Furthermore, we have to deal with things
10 that are really different in the generic classification, not
11 just that they appear to be different but that have some
12 clinical significance or some claim-based difference. I
13 think you have brought that up. So, the coated and non-
14 coated could have a claim-based difference, that bone
15 ingrows in the coated and, therefore, that would be a
16 difference and a supposed superior characteristic. Whether
17 or not it was clinically is another issue.

18 MR. LARSON: Right. I guess what I am trying to
19 avoid is splitting hairs even, say, within TPS coatings and
20 saying, well, this one is a little bit less porous; this one
21 is a little bit more porous. If they are intended for
22 surface and not intended for tissue ingrowth, then I would
23 say that would essentially all be the same.

24 DR. GENCO: So, are you comfortable with the two

1 major categories, root form and blade, and under those, a
2 subdivision of coated and non-coated? Then the coated is
3 porous and non-porous?

4 MR. LARSON: Then you are splitting hairs on TPS,
5 for example, because if you look at the way Angela has
6 outlined it for us, she is making a distinction within TPS
7 coatings.

8 DR. GENCO: Are these really different?

9 MS. BLACKWELL: They have different indications in
10 some cases.

11 DR. GENCO: So they are different. So there would
12 be different indications.

13 MR. LARSON: For example, there is one category of
14 TPS coating that is used on orthopedic implants, on hips,
15 that is much more porous and is intended for tissue
16 ingrowth. I don't think that is what we are talking about
17 with any dental implant. So, I guess that distinction --
18 are there different indications within TPS-coated dental
19 implants?

20 MS. BLACKWELL: I don't know of any TPS that have
21 anything besides surface roughening. There are some
22 coatings that are more porous than TPS, that imply that they
23 are for bone ingrowth.

24 MR. LARSON: Okay, but I think there may be TPS

1 coatings that would fall into your more porous category that
2 are just those normal dental implant TPS coatings.

3 MS. BLACKWELL: yes, that is possible.

4 MR. LARSON: So I am just saying we are splitting
5 it too finely there.

6 MS. BLACKWELL: Perhaps we should split it
7 differently. Maybe coatings for biologic fixation,
8 according to the definition, and coatings that are for
9 roughening.

10 DR. DRUMMOND: Are you talking about pore sizes
11 for bone ingrowth then?

12 MS. BLACKWELL: Yes, sir. There is already one
13 established for hips.

14 DR. DRUMMOND: But is that what you want to apply
15 here because porosity -- I mean, I am having trouble what is
16 porous and what is not porous.

17 DR. GENCO: Well, there is an average pore size
18 given

19 DR. DRUMMOND: But that is not the same thing as
20 porous, from my point of view.

21 MS. BLACKWELL: The coating listed in the CFR for
22 hips is defined by volume porosity, average pore size, that
23 it has interconnecting pores, and a certain coating
24 thickness.

1 DR. DRUMMOND: Is that what we are talking about
2 here?

3 DR. GENCO: We put it on the floor as a definition
4 of porous, with the caveat that the thickness would be
5 different.

6 MS. BLACKWELL: Yes, that is the way it was
7 originally.

8 DR. GENCO: So, porous has a very definite
9 definition, 37% volume porosity, pore size of 100-1000
10 microns, with interconnecting pores. So, that is a
11 definition of porous and everything else is non-porous.

12 DR. DRUMMOND: And I am referring to the last
13 sentence of her description, and just distinguishing between
14 that and the TPS which is merely surface roughening, which
15 is not an important distinction.

16 DR. GENCO: Let's only make distinctions that are
17 meaningful and important. We already have a very
18 complicated system here.

19 MS. BLACKWELL: Maybe we shouldn't use porous; we
20 should just use coatings for biological fixation. That way,
21 those that don't fit the definition for biological fixation
22 fit in the other category of coatings.

23 DR. GENCO: so, two categories of coatings,
24 coatings for biological fixation and other coatings, and

1 then non-coated.

2 MS. BLACKWELL: Yes.

3 DR. GENCO: Let me just articulate that. So, we
4 have root form and blade and under each we will have
5 coatings for biological fixation, other coatings and non-
6 coated. What are the other coatings for?

7 MS. BLACKWELL: Well, as far as I know, the other
8 coatings are only for surface roughness, but that is not to
9 say that is going to be the only claim.

10 DR. STEPHENS: Wouldn't that be for biologic
11 fixation also?

12 MS. BLACKWELL: No.

13 DR. STEPHENS: Because there are some surface
14 preparations that claim that the roughness facilitates bone
15 conduction.

16 MS. BLACKWELL: That is what we are trying to
17 separate out.

18 DR. STEPHENS: Should we say tissue ingrowth
19 rather than biologic fixation?

20 MS. BLACKWELL: I was using the definition that
21 was given in the CFR.

22 DR. REKOW: What is that definition, just for
23 clarity?

24 MS. BLACKWELL: If you look at page two of your

1 gird sheet, it is listed there.

2 DR. REKOW: That is defined as biologic fixation.

3 MS. BLACKWELL: Biological fixation. It is
4 defined for metallic-coated hips in the CFR. It was done by
5 their panel, I believe.

6 DR. GENCO: The first question with respect to
7 that is do we agree with that? Does that make sense for
8 dental implants?

9 MS. BLACKWELL: Except for the thickness.

10 DR. GENCO: Except for the thickness. So, that
11 would give us three subcategories, porous for biological
12 fixation, and that has a very definite definition; other
13 coatings; and non-coated.

14 DR. STEPHENS: Why do we want to do that, again?
15 I don't see any practical reason for that separation.

16 DR. GENCO: Okay, now we are getting back to just
17 two, root form and blade. We have a suggestion not to talk
18 about the coatings and we would have just two subgroups,
19 root form and blade.

20 DR. REKOW: But I think that Dr. Drummond's
21 comment about the interface being a potential concern is a
22 valid one, and I would be reluctant to throw that out.

23 DR. GENCO: Okay, articulate that. Do you want to
24 subgroup that into interface and no interface?

1 DR. PATTERS: Coated and uncoated.

2 DR. DRUMMOND: That puts us back to coated and
3 uncoated then. I mean, if we are adding an additional step
4 that puts a new interface in there by adding a different
5 material, I mean, coated versus uncoated in this context I
6 guess is the same but to material science it is not. But I
7 will back out of that one. But, basically, this is an
8 additional manufacturing step, as I understand it, to put
9 this layer on which may or may not enhance bone ingrowth.
10 So, you have a machined implant that you may modify in some
11 sense but you don't have an additional material that you are
12 plasma-spraying, heat-treating or something to put on the
13 surface.

14 DR. GENCO: Why are we subgrouping at all? Susan,
15 do you want to bring us back to why we are subgrouping? Is
16 it for indications?

17 DR. RUNNER: Yes, it is for indications.

18 DR. GENCO: Okay. Are there different indications
19 for root-form coated and root-form non-coated? Indications
20 for use or indications for intended use?

21 DR. DRUMMOND: I thought the implication for the
22 coated versus the uncoated was an increase in fixation time
23 or an implied faster ingrowth of the bone if you had a
24 certain modification on the surface, whether it was grit-

1 blasted or hydroxylapatite or whatever -- a pore size was
2 available for the bone to grow into. I thought there was an
3 implied enhancement for these particular implants.

4 DR. GENCO: How does the rest of the Panel feel?

5 DR. REKOW: Does it make a difference in terms of
6 when you load it? Does that give you some sense of the
7 indication? I mean, if you have the biologic ingrowth can
8 you load it sooner or later? I don't know the answer to
9 that.

10 DR. PATTERS: I am not convinced there is really
11 evidence that coated implants have a different indication
12 than the uncoated implants, or a different success rate.

13 DR. HEFFEZ: I would agree. I think many
14 clinicians have in their own mind this situation that they
15 would rather use a cylindrical implant or a screw implant,
16 but I think it has actually been studied whether in one
17 situation or another screw or cylindrical implant would be
18 indicated.

19 DR. GENCO: Okay. Now let's go to the root form
20 and the blade. Are there different indications for that
21 subclassification? Are there different indications for
22 blades versus root forms?

23 DR. PATTERS: Yes.

24 DR. GENCO: So, that makes sense. I have a

1 suggestion. Let's take a ten-minute break. Be back here at
2 3:00.

3 (Brief recess)

4 DR. GENCO: We will start with some comments from
5 Dr. Runner. She will help us in our deliberations. Dr.
6 Runner?

7 DR. RUNNER: Yes, I think that there is a little
8 bit of confusion and I want to clarify what we are asking
9 you to do today. In looking at the grid that we have
10 displayed, and this grid is simply based on our looking at
11 all the types of implants that have come in through 510(k)
12 applications and separating them out in terms of types and
13 indications, we want you to look at the implants and their
14 indications for use and decide what degree of regulatory
15 control is necessary to reasonably assure safe and
16 efficacious use of the implants. That is basically what we
17 would like you to do.

18 In looking at this grid, we would also like you to
19 pull out any groups that you think need any different degree
20 of regulatory control. The grid, in and of itself, has no
21 meaning except that we made it up, and it is an easy way to
22 look at the different types of implants and their
23 indications. But if you feel that in your clinical
24 experience implants for certain indications are reasonably

1 safe and efficacious, we can then deal with other types of
2 guidance documents or special controls that would ensure
3 safe and efficacious use at a later point. But right now we
4 are just asking what you feel is the degree of regulatory
5 control necessary to reasonably assure safe and efficacious
6 use of these implants for these indications.

7 To reiterate, are there any groups on this chart
8 that need to be pulled out that need any different degree of
9 regulatory control? Does that clear things up a little bit?

10 DR. GENCO: It is a little different task than
11 regrouping.

12 DR. RUNNER: Well, in terms of the grouping, we
13 thought that when we looked at this grid initially it looked
14 very daunting. There are lots of groups and lots of types.
15 We thought it would be easier for you to possibly group some
16 of them together. Clearly, it doesn't seem to be easier,
17 but we thought that it would be easier for you to lump some
18 groups that might have similar properties. If it isn't
19 easier, then you can skip that. That would be acceptable as
20 well.

21 DR. GENCO: In terms of lumping, we have lumped
22 all the root form, cylinder, screw together. That is one
23 lumping that the Panel seems to agree is reasonable. Is
24 there any objection to that?

1 (No response)

2 And that that group be different from the blade
3 form, different indications. In terms of lumping together,
4 I have heard suggestions for all the coated to be lumped
5 together and all the non-coated to be lumped together.

6 Let's go over that again. Yes?

7 MR. LARSON: I think the premise that we had
8 before suggesting that non-coated and coated not be lumped
9 together was our thinking that FDA needed that distinction
10 in the way the classification was listed in order to deal
11 with the special controls. But what we are hearing now is
12 that they don't need that. As long as we think, based on
13 the clinical data, that they are equivalent in performance,
14 and we intend to give them the same classification, we don't
15 have to worry about that.

16 DR. RUNNER: Correct, and you can then specify the
17 controls that would be necessary to assure safety and
18 efficacy.

19 MS. BLACKWELL: You could put special controls for
20 the different types according to claims. If someone wants
21 to claim tissue ingrowth, you could specify certain things
22 they would have to meet, or specify certain things for all
23 coated ones, certain adhesion strength or something like
24 that. But they wouldn't necessarily have to be grouped

1 separately.

2 DR. GENCO: So, if there were just these two
3 subgroups, root form and blade, that would help the FDA?
4 Then if someone made a claim for tissue ingrowth with a
5 coated implant, then there would be a special guidance to
6 prove that?

7 DR. RUNNER: Yes.

8 DR. GENCO: And we could suggest a special
9 guidance.

10 DR. RUNNER: Yes, after seeing more data you could
11 specify certain physical characteristics or something like
12 that.

13 DR. HEFFEZ: Would you have to define what the
14 root-form implant encompasses? You would have to say that
15 it includes porous, non-porous, coated, with a footnote?

16 MS. BLACKWELL: You could just say that root form
17 includes all root-form ones. If you don't specify whether
18 it is coated or uncoated, if it encompasses all of them, all
19 root-form implants.

20 DR. HEFFEZ: I am saying if somebody comes in with
21 a root-form implant that claims tissue ingrowth, how do you
22 say that you didn't consider it in your original
23 classification?

24 DR. RUNNER: You don't necessarily have to

1 consider every single potential difference in an implant.
2 You just have to come up with controls that in general would
3 provide for safe and efficacious use, and we can worry about
4 the regulatory aspects of how we would deal with
5 differences.

6 MS. SCOTT: Maybe just to add to that, when the
7 Panel gets to the point of actually recommending a
8 reclassification for endosseous dental implants, the Panel
9 can recommend what they feel is appropriate for the
10 description of the device. So, if the Panel feels a generic
11 description is more appropriate, that is what they can
12 recommend. If they feel a more detailed description is
13 appropriate, then they may recommend that. FDA will then
14 take that recommendation and move forward.

15 DR. GENCO: So, we have then two subgroups, the
16 root form and the blade. Are there any other subgroups? Is
17 there a subgroup of implants with special retention
18 features? Is there a subgroup of temporary implants? Are
19 those two other subgroups?

20 MS. BLACKWELL: I think those two are appropriate
21 subgroups.

22 DR. GENCO: Any comments about those two
23 subgroups? We would have four subgroups.

24 DR. REKOW: What about the zygomatic ones? Are

1 they part of the root form?

2 DR. GENCO: I am sorry?

3 DR. REKOW: What about the zygomatic implants?

4 DR. GENCO: The question is about the zygomatic
5 implants.

6 MS. BLACKWELL: That is an implant with a special
7 retention feature.

8 DR. REKOW: Thank you.

9 DR. GENCO: Or is that an implant in a different
10 anatomic are? I think that is probably what it is. From
11 what I heard, they are not special implants --

12 MS. BLACKWELL: No, it is a larger implant. If
13 you remember, when I spoke about special retention features,
14 those are implants that have some component of the design
15 that makes them substantially different from the standard
16 screw, cylinders or hybrids. Examples of this would be a
17 movable part for increased retention or a design to allow
18 the implant to be placed in a different location than the
19 usual system. The second part, different location than the
20 usual system, would be a zygomatic implant.

21 DR. GENCO: Okay.

22 DR. REKOW: So orthodontic on-plants would be the
23 same kind of category?

24 MS. BLACKWELL: What was that?

1 DR. REKOW: The orthodontic on-plants that you put
2 in the palate, they would fit into that?

3 MS. BLACKWELL: Yes.

4 DR. GENCO: So, that category then would include
5 any implant with a special retention feature. The examples
6 that we have are the on-plants, the zygomatic and the apical
7 expansion implant.

8 MS. BLACKWELL: Yes.

9 DR. GENCO: And there may be others.

10 MS. BLACKWELL: Yes. That is also the place where
11 some new technology implants could fall.

12 DR. GENCO: Okay. What about the temporary
13 implants? Does the Panel feel that that is a sufficiently
14 different indication? Yes?

15 DR. HEFFEZ: I just want to go back for a minute.
16 Where do the craniofacial, orbit and mastoid, implants fall?

17 MS. BLACKWELL: They aren't being discussed in
18 this grouping. I believe they have a separate
19 classification.

20 DR. GENCO: So, we are talking about endosseous
21 dental.

22 DR. HEFFEZ: I think we have to make that
23 distinction.

24 DR. GENCO: Right. So, these are endosseous

1 dental implants.

2 MS. BLACKWELL: Yes.

3 DR. GENCO: So, so far we think that there are
4 four subcategories with clear differences for indications.
5 Let's finish the discussion of the surface coating. There
6 is not sufficient evidence that they have different
7 indications?

8 DR. DRUMMOND: If we want to do this, I guess I
9 would just put coated and other, and leave it at that. The
10 coated is a special process to add --

11 DR. GENCO: Is there a specific indication for it?
12 Where would you use coated and not use coated?

13 MS. BLACKWELL: There is not really any difference
14 in indication.

15 DR. GENCO: There is not, as far as you can see in
16 the 510(k)s?

17 MS. BLACKWELL: Well, I mean, they are for the
18 same indication. Some coated ones imply that they have
19 better retention at the beginning but there is no difference
20 for indication. One is just supposed to be an improvement.
21 As we saw from the clinical data, there is not much
22 difference in success rate.

23 DR. STEPHENS: I think in general clinical
24 experience there really is no specific indication. There

1 are individuals or groups who feel that they like to use,
2 for example, an HA-coated implant in the posterior maxilla,
3 but I don't think anyone would say that there were any
4 specific indications for any of them.

5 MS. BLACKWELL: I don't believe there are any
6 companies that are marketing them that way either.

7 DR. STEPHENS: Not that I know of.

8 DR. GENCO: So, what we are suggesting is four
9 subgroups, root form, blade, implants with special retention
10 features and temporary implants.

11 DR. PATTERS: What about those for extraction,
12 that have indications for use in extraction sites? Let me
13 ask, are there any that actually claim such an indication?

14 MS. BLACKWELL: Extraction site?

15 DR. PATTERS: Yes.

16 MS. BLACKWELL: Yes, there are several companies
17 that have that in the labeling currently.

18 DR. PATTERS: And is there data to suggest that
19 they are better in extraction sites?

20 MS. BLACKWELL: No. It is just that not every
21 company has applied for that in their 510(k).

22 DR. PATTERS: Well, it seems to me that is a
23 different indication.

24 MS. BLACKWELL: If you look at the top of the

1 grid, it is listed as one of the indications that is
2 separate.

3 DR. PATTERS: But I would argue that is a
4 different indication than putting an implant in an osteotomy
5 site.

6 DR. GENCO: The question is, is there a specific
7 design or other feature of a generic class of implants, just
8 for fresh extraction sites.

9 MS. BLACKWELL: No.

10 DR. GENCO: Therefore, it wouldn't be a subgroup.

11 MS. BLACKWELL: No.

12 DR. GENCO: It would be an indication --

13 MS. BLACKWELL: Yes.

14 DR. GENCO: -- but not a specific subgroup that
15 only fits that indication. For example, there is a subgroup
16 for special retention features. They are very different
17 from others.

18 MS. BLACKWELL: Yes, but those that are used in
19 fresh extraction sites, as they are cleared currently, are
20 also two-stage implants or two-stage implants as well.

21 DR. GENCO: Mark, are you satisfied? It wouldn't
22 be a special subgroup.

23 DR. PATTERS: I am not understanding then why
24 those with special retention features, if they don't have

1 any different indication, why are they a subgroup?

2 MS. BLACKWELL: They have a very different design.

3 DR. PATTERS: But they don't have a different
4 indication.

5 MS. BLACKWELL: In some cases they do.

6 DR. PATTERS: Such as?

7 MS. BLACKWELL: Well, zygomatic is placed in a
8 very different way.

9 DR. GENCO: The orthodontic on-plant.

10 MS. BLACKWELL: Yes, the orthodontic on-plant is
11 definitely a different indication.

12 DR. PATTERS: Okay.

13 MS. BLACKWELL: Some of the ones with special
14 retention features, it is possible they could be indicated
15 for areas that don't have as good quality bone as you would
16 use in a normal implant.

17 DR. PATTERS: That is possible but is that --

18 MS. BLACKWELL: Well, that is why you use the
19 zygomatic implant, because you don't have quality of bone.

20 DR. PATTERS: I am unaware of any compelling data
21 to support any of these implants for special uses.

22 MS. BLACKWELL: What?

23 DR. PATTERS: There is no data.

24 DR. GENCO: Well, I think we are really not

1 talking about that now. That comes later. What we are
2 talking about is, is there a generic class of implants with
3 special retention features, and I guess the answer is yes.
4 I mean, they are already on the market.

5 MS. BLACKWELL: Yes, some of them are.

6 DR. GENCO: So we want to give that a
7 classification and then, if it is a subclass the data comes
8 in terms of categorization.

9 DR. PATTERS: Okay.

10 DR. RUNNER: I think also that it is important to
11 remember that if there are significant differences in the
12 special controls that you would apply to different groups,
13 then there may be some advantage in separating the groups
14 out. If there aren't any differences in the special
15 controls, then it would not necessarily be an advantage to
16 separate the groups out.

17 DR. GENCO: Okay, so that is another criterion for
18 subgrouping. That is, if there are differences in special
19 controls. Would that then get us back to the coating?

20 (Laughter)

21 MS. BLACKWELL: I don't think those differences in
22 special controls would matter. The special retention
23 features, it is possible that because of the uniqueness of
24 most of these systems that is going to be difficult to lump

1 with the others because every one of the systems probably
2 would need different special controls.

3 MS. SCOTT: I was going to try to generically help
4 with answering the question Dr. Patters had in reference to
5 the implants with special retention features being a
6 separate group, or a separate classification, and then
7 looking at indications. Devices are classified based on the
8 device type -- I believe Susan may have stated this earlier
9 but to reiterate, devices are classified based on type and
10 indication, and the classification then -- you could have a
11 device that is classified for one indication that could also
12 be classified differently for a different indication. So,
13 we are looking at both device type and indications. Does
14 that help?

15 DR. GENCO: To reiterate, based upon type and
16 indication, we have root form, blade, implants with special
17 retention features and temporary implants. Any further
18 discussion of the subclassification from the Panel? Is
19 everybody happy with that? I would like to ask anybody in
20 the audience if they can add anything to that, or feel that
21 that is reasonable.

22 (No response)

23 Let's go to the question of the anatomical
24 location. This is question one, as we consider

1 classification of endosseous dental implants, should we
2 continue to consider implant location as a component of the
3 device's indication for use?

4 Anybody want to start discussion on that? Does
5 anybody feel that that is now an issue?

6 DR. HEFFEZ: I feel it is no longer an issue.

7 DR. GENCO: Further comment?

8 DR. DRUMMOND: We have a lot of percentages. Do
9 we have any statistical analyses to show that there is no
10 difference in the percentages?

11 DR. PATTERS: I think there is a difference
12 between the mandible and maxilla.

13 DR. HEFFEZ: But we were just told there wasn't.

14 DR. PATTERS: Well, the success rate is higher --

15 DR. HEFFEZ: I mean, we have lots of clinical
16 studies. Is there any way to statistically compare to see
17 if there really is a statistical difference, or is it just
18 numbers? I think the best way to look at it is really not
19 the maxilla and the mandible but the quality of the bone.
20 If the bone was exactly the same in the mandible as in the
21 maxilla, and it is at times very good quality bone, then the
22 success rate is comparable. So, it is not the anatomical
23 location that drives it, it is the quality of bone that
24 drives it.

1 MR. LARSON: The other thing that drives it, of
2 course, is the skill of the surgeon, the prosthetic
3 restoration, all of that has an effect. Again, we are not
4 dealing with the statistics but there is a good chance that
5 it kind of washes out the rather subtle differences that we
6 are seeing anyway.

7 DR. GENCO: Another way of putting this might be
8 is there any area of the oral cavity that is
9 contraindicated?

10 DR. HEFFEZ: Only when the conditions are such
11 that there is inadequate bone and the patient doesn't wish
12 to have a grafting procedure etc.

13 DR. GENCO: Yes, those are obvious surgical
14 contraindications, but there are no contraindications in
15 maxillary tuberosities or mandibular second molar areas. Is
16 there data that implants should be used because there is a
17 terrible failure rate in certain areas all the time?

18 DR. HEFFEZ: No.

19 DR. GENCO: Okay. Number three, about the
20 abutments. WE have already had some discussion about
21 abutments and should they be classified separately? First
22 of all, should they be classified separately? The FDA wants
23 us to give them an opinion on this. What are your thoughts?
24 Can we have some discussion? Andrea, do you want to give us

1 an opinion on that?

2 DR. MORGAN: I don't think they should be
3 classified separately from the implants. It is part of the
4 same system. Once you place an implant, it needs to be
5 restored with an abutment. It seems like it should go under
6 the same scrutiny. The same standards should be applied to
7 both the implant and the abutment system. So, in that
8 respect, it should be one and the same.

9 DR. GENCO: Other opinions on that? Comments?
10 Mark?

11 DR. PATTERS: I don't think I agree. I could see
12 the possibility of certain types of implants being
13 classified as class III devices, yet, being able to use an
14 abutment that is also used under class II devices. So, the
15 abutment should have different classifications, depending on
16 what type of implant was going with it. So, I would say I
17 think they need to be classified separately. The abutments
18 don't necessarily belong to the system. There are many
19 companies that just make abutments.

20 DR. GENCO: What is the present status? I have
21 heard some comments about implant accessories. These are
22 not abutments but what is the present status of accessories?

23 DR. RUNNER: Accessories at this point, and
24 abutments, are considered part of the implant system and, as

1 such, are all class III devices. However, we are
2 recommending an initiative to separate out the accessories.
3 That did not include the abutments. Those are surgical
4 tools and so forth.

5 DR. GENCO: So, the question in your mind is still
6 on the table. So, there are two opinions. One is that they
7 be included with the implant and the other is to separate
8 them out. Yes?

9 MR. LARSON: A practical consideration in favor of
10 separating them out is just the numbers of combinations and
11 the difficulty of getting clinical data on abutments even
12 for companies that make the implants and abutments, let
13 alone for the companies that only make the abutments. So,
14 just from a practical standpoint it seems appropriate to
15 separate them out.

16 DR. GENCO: Okay. Further comments?

17 DR. HEFFEZ: Another reason for separating them
18 out is the problems that you encounter with implants are
19 many times different to the problems with the abutments.
20 Those that are really a problem with the abutment can result
21 in not being able to be used with the implant and you have
22 to use a different abutment. So, I do think that we have a
23 different array of problems that could occur and, therefore,
24 I think we should consider them separately.

1 DR. STEPHENS: Do the prosthodontists think that
2 we should consider the abutments manufactured by the same
3 implant maker the same as abutments that are manufactured by
4 other companies for any implant, manufactured by a company
5 that makes no implants but only makes abutments?

6 DR. DRUMMOND: I don't think that a manufactured
7 implant system should get a special dispensation. I am
8 beginning to think that we are going to have to consider the
9 abutments separate from the implant system as a total
10 product. I don't know how we can evaluate the total system
11 without breaking it down into components.

12 DR. GENCO: Any other comments? So, I hear the
13 suggestion from the Panel, at least most of the Panel, that
14 abutments should be broken out and be classified separately
15 from the implants. Yes?

16 DR. STEPHENS: I wonder if the implant company
17 representatives have any comments about use of other
18 abutments with their system.

19 DR. GENCO: Does anybody want to comment on that?
20 Yes?

21 DR. WAGNER: Thank you. Bil Wagner, with
22 Sulzer/Calcitek. While we don't have any specific data to
23 offer you on this, we have had a long-standing concern about
24 after-market companies offering abutments that they claim

1 are compatible with our implants. Our concern is based on
2 the fact that we engineer our implants under very tightly
3 controlled tolerances and dimensions which we do not
4 publish. So, I must make the assumption that the after-
5 market company is somehow magically determining what those
6 tolerances are for our own abutments. We have no way of
7 controlling that.

8 The other concern is that should there be a
9 problem with the implant as a result of this after-market
10 implant, the problem comes back to us, the implant company.
11 We are forced to report it as an implant failure, even
12 though the failure may have been caused by something
13 completely beyond our control.

14 DR. GENCO: Thank you. Yes?

15 DR. MARLIN: I think we need to straighten out a
16 few things here about the difference between clinical
17 efficacy and safety and effectiveness, and perhaps self-
18 serving economic benefits to the company that is making
19 implants. In response to what was just said, the reality is
20 that to make a perfect abutment to match a perfect implant
21 you would literally have to create your implant slot, and
22 use the same drill to create the abutment so your tolerances
23 were 100%. The realities are that when an abutment company
24 makes an abutment, they fabricate it to a tolerance level

1 that is to the standard that they want. If we make a
2 tolerance level to 0.0003 of an inch, then it is a tolerance
3 level of 0.0003 of an inch regardless of whether you are
4 looking at that implant's tolerance levels -- that is their
5 tolerance level.

6 Let's stop a second here. We are talking about
7 two different safety and effectiveness issues. Abutments,
8 basically, do not cause implant failure. If an abutment
9 breaks, it is replaced. If a screw breaks, it is replaced.
10 If an implant fails it has a totally different safety and
11 effectiveness issue. And I think we need to stop and ask
12 ourselves what are we dealing with here? Are we dealing
13 with safety and effectiveness when we come up to the podium
14 and say, well, we have a problem with after-market companies
15 making abutments, or are we dealing with an economic issues
16 because we are threatened by it? In fact, quite honestly,
17 the restorative dentist, when they have a problem, they come
18 to us. They don't go to the implant manufacturer. They
19 come to the place where they had the abutment or the screw
20 made. So, what I would say to you, once again, is the
21 abutment is a stand-alone device because it has a separate
22 safety and effectiveness issue. It has almost a zero
23 morbidity level where it cannot be fixed, replaced or
24 changed and, at the same time, the implant has different

1 problems.

2 DR. GENCO: Thank you. Yes?

3 MS. BROWN: My name is Betsy Brown. I am with the
4 Nobel Biocare Company, and I would like to address the
5 abutment fixture issue. First of all, the implant system
6 and the fixtures go together. You can't really divorce the
7 two. However, objectively speaking, Nobel Biocare has years
8 of experience and data where we have actually proven the
9 safety and efficacy of our products with the abutments that
10 we make. I see where there are abutment failures and they
11 come back to us, even though it is not our abutment. So, I
12 think objectively speaking, if you look at the clinical data
13 that is out there and not assume things, the data supports
14 for the Branemark system the abutments that we manufacture
15 with the tolerances and the material, etc. to support our
16 particular fixtures.

17 DR. GENCO: Thank you. Any further comments or
18 discussion?

19 (No response)

20 The last issue we have been asked to address is
21 what information would be helpful to the Panel prior to the
22 next Panel meeting, or at least a Panel meeting at which
23 classification of endosseous dental implants will be
24 discussed? Anything on that discussion? Yes?

1 DR. PATTERS: Well, I would like to hear at the
2 next Panel meeting from the implant companies who has
3 indications which go slightly beyond the standard
4 indications for an endosseous dental implant, such as
5 placement in special areas of the oral cavity, and what they
6 would have to support their implants in those special areas.

7 DR. GENCO: Okay, we have had a call for rationale
8 and justification of data to support, other than the obvious
9 indication which is to replace teeth --

10 DR. PATTERS: Right.

11 DR. GENCO: -- special indications for special
12 uses.

13 DR. PATTERS: The usual indication is that
14 endosseous dental implants are used to replace teeth. So,
15 if there are other sites that people are claiming an
16 indication for, I would like to know what those indications
17 are, and what basis there is that that particular implant is
18 efficacious for such an indication.

19 DR. GENCO: Okay. Any discussion on that?

20 DR. PATTERS: Or, for example, if someone were to
21 say that their implant had an indication for use in an area
22 of cancellous bone where there are minimal amounts of
23 cortical bone. If someone is claiming such an indication, I
24 would like to see if there is special coating etc. So, I

1 would like to know if there are such special indications and
2 if there are data to support them.

3 DR. GENCO: Any comments on that from the Panel?
4 Is everybody happy with that? Anything else you would like
5 to see?

6 DR. REKOW: Mr. Chairman, if it is possible, I
7 would like to see more of the failure data. It would be
8 useful to know when the failures are occurring and what
9 kinds of failures are occurring early and what kinds of
10 failures are occurring later. That would be helpful, I
11 think, for myself.

12 DR. JANOSKY: There is a follow-up to that,
13 referring to life table analyses, maybe more fine
14 distinctions, perhaps every six months the percentage of
15 failures; what is the percentage of the successes, up to the
16 five years whenever the data are available, as well as some
17 further analyses perhaps on placement in the mouth.

18 MR. LARSON: Just to comment on life table
19 analyses, conventionally they are done on an annual basis
20 and it is sometimes difficult to dice and slice them. In
21 terms of the frequency of follow-up, you are not going to
22 get them necessarily.

23 DR. GENCO: Any other things you would like to
24 see? We want to see safety and efficacy data on the four

1 subgroup, root form, blade, implants with special features
2 and temporary implants. We have seen a lot of data on root
3 form; some data on the blades. I think we have seen a lot
4 of data on implants with special features and retention
5 features for the temporary implants, regarding safety and
6 efficacy. Anything else? Susan, do you have any comments
7 about additional information that would be useful to you?

8 DR. RUNNER: No, I sense that feelings about
9 coatings are not finalized. I would like the Panel members
10 to think about any information that they feel would be
11 necessary before the next Panel meeting.

12 DR. GENCO: Okay, with respect to coatings?

13 DR. RUNNER: With respect to coatings.

14 DR. GENCO: Anyone have any problems with that?
15 Jim, what would you like to see with respect to coatings?

16 DR. DRUMMOND: Well, if I had my choice, I would
17 like to see a comparison study between coated versus
18 uncoated and ceramic versus metal.

19 DR. REKOW: With ten-year follow-up. Right?

20 (Laughter)

21 DR. GENCO: Further comments about coating?

22 DR. STEPHENS: I have a question to FDA. Are
23 transmandibular implants and staple implants included in the
24 special retention groups, or are they addressed by

1 themselves?

2 MS. BLACKWELL: Transmandibular have are separate.
3 They are currently unclassified.

4 DR. GENCO: But they are not in the major group of
5 endosseous dental implants?

6 MS. BLACKWELL: No, they are not. Since they are
7 unclassified, they show up by themselves.

8 DR. GENCO: Okay, any other information that you
9 would like to see before the next meeting?

10 (No response)

11 Well, we are on schedule. Is there anything else
12 we need to discuss before we leave endosseous dental
13 implants?

14 DR. ALTMAN: I have a question. Where do the
15 transitional implants fit?

16 DR. GENCO: You mean temporary?

17 DR. ALTMAN: Well, it alluded to the fact that
18 some of them lasted a couple of decades.

19 MS. BLACKWELL: That is actually transitional. A
20 transitional device has a different definition. So, we
21 don't use that term; we use temporary.

22 DR. GENCO: That subcategory is called temporary.
23 The concept of transitional is included in that.

24 DR. HEFFEZ: The nomenclature originally had

1 listed hybrids, and we didn't see data presented on hybrids.
2 That should be presented.

3 DR. GENCO: Okay, so noted. Let's now go to the
4 next topic, and that is classification of intraoral
5 appliances for treatment of obstructive sleep apnea and
6 snoring. Pamela, you have a comment before we go on?

7 **Committee Business**

8 MS. SCOTT: Before we go on, because a lot of
9 people were interested in when we will be holding our next
10 panel meeting, if I could ask the panel members and
11 consultants if they have had a chance to look at their
12 calendars at least for January to determine when in January
13 they--I believe we had asked a number of the panel members
14 and consultants but not all if January 12 and 13 is
15 acceptable, 12, 13 and 14.

16 DR. GENCO: Any problems with those dates? Does
17 anybody from industry know if that interferes with a major
18 meeting or concern of theirs?

19 MS. SCOTT: All three days? I am not sure we will
20 need all three days, but the 12th, 13th and 14th, I know Dr.
21 Altman said he had a conflict on the 12th. Does anyone have
22 a conflict with the 13th and 14th? For now, we will
23 tentatively set our next panel meeting date for January 12,
24 13 and 14. We will publish in the Federal Register the

1 extact dates of the meeting when we have come to a final
2 decision, and also you can call the advisory committee
3 hotline.

4 DR. GENCO: Thank you very much.

5 CLASSIFICATION OF INTRAORAL APPLIANCES
6 FOR THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA AND SNORING

7 DR. GENCO: So that we stay on schedule, let's
8 talk now about the classification of the intraoral
9 appliances for the treatment of obstructive sleep apnea and
10 snoring.

11 **Open Public Hearing**

12 The first topic on the agenda is the open public
13 hearing. Is there anybody here who wants to make a comment
14 about the appliance for treatment of obstructive sleep apnea
15 and snoring.

16 Dr. Scharf?

17 MS. SCOTT: If I could first ask our invited
18 guests to come forward to the table here. We have Dr. Barry
19 Hendler with us, Dr. Eric Furst and Dr. Glenn Clark. Very
20 briefly, I will introduce them. Dr. Barry Hendler is
21 associate professor of oral and maxillofacial surgery and
22 the director of postgraduate medical education and the
23 coordinator of laser and cosmetic surgery with the
24 University of Pennsylvania Medical Center.

1 Dr. Eric Furst is a surgeon with a specialty in
2 ear, nose, throat, head and neck. He is also board
3 certified and he practices in Springfield, Virginia. We
4 have Dr. Glenn Clark who is the chair of the section of
5 diagnostic sciences and oralfacial pain with the University
6 of California at Los Angeles.

7 DR. GENCO: Welcome. Proceed.

8 DR. SCHARF: I am Dr. Martin Scharf. I am the
9 Director of the Tristate Sleep Disorders Center of
10 Cincinnati. I have been active in sleep disorders research
11 and medicine for over 30 years and have published over 200
12 papers, chapters and notes regarding issues related to
13 sleep.

14 Like most sleep clinicians, the majority of the
15 patients that I see in the clinic are those complaining of
16 symptoms related to snoring and possible sleep apnea. While
17 the majority of the patients are physician-referred, in part
18 because of the dictates of the managed-care providers, many
19 present on their own, often at the urging of their spouse or
20 after having experienced a series of events related to
21 fatigue and sleepiness while working, driving or operating
22 some type of dangerous equipment.

23 Like most sleep clinicians, we don't believe that
24 everyone who snores has sleep apnea nor does snoring, in and

1 of itself, suggest the need for polysomnography. However,
2 while snoring is not always sleep apnea, I believe that it
3 is correct to say that the sleep of snorers requires greater
4 effort and is, thus, likely to be less refreshing and less
5 restorative than that of non-snorers and, in general, is not
6 as benign as we might have thought some years ago.

7 Nasal CPAP and surgical interventions have been
8 shown to be effective for both snoring and obstructive sleep
9 apnea. In our experience, CPAP works in over 90 percent of
10 the patients with surgical interventions in something
11 slightly over 50 percent. The latter seems to be more
12 effective in correcting snoring than obstructive apnea but
13 up to a third of the apnea patients cannot or will not
14 tolerate nasal CPAP as a treatment for apnea and it is an
15 expensive overkill for simple snoring.

16 Indeed, most insurance carriers would not support
17 using CPAP for simple snoring. Further, the UPPP, the
18 uvulopalatopharyngoplasty, whether carried out with a
19 scalpel or with laser or with RF, while effective for simply
20 snoring, is often not effective in resolving apnea. We
21 believe that this is primarily because of contributions of
22 base of the tongue area to the condition.

23 Now, today, in our experience, there are over 30
24 commercially available dental appliances that have been

1 promoted as treatments for snoring and sleep apnea. Indeed,
2 the American Sleep Disorders Association has agreed that a
3 body of scientific data supports the efficacy of these
4 appliances in many of these patients.

5 There is no data that I am aware of that suggests
6 that any one of the appliances is any more effective than
7 any other since they all, essentially, carry out the same
8 function; that is, to stabilize the tongue and provide
9 various degrees of mandibular advancement. Indeed, one of
10 the devices, the tongue-retaining device, goes beyond that
11 and has the patient sleeping with their tongue extending
12 outside of their mouth. But, in all cases, the goal is to
13 widen the airway.

14 Because of the wide range in costs of these
15 products and the initial ones, by the time you got through
16 fitting a patient for them, could cost as much as \$5,000
17 with all the testing that was involved, but, today, they
18 range, on average, from \$300 to \$1500, depending on who is
19 doing it.

20 The relative lack of awareness or understanding of
21 the appliances by third-party decision makers, as well as
22 the confusion as to whether or not these are medical or
23 dental devices, in most cases, third-party carriers, in our
24 area, do not provide reimbursement for the appliances nor do

1 they support polysomnographic evaluations to evaluate their
2 effectiveness.

3 As a result of that, we have been searching for a
4 method of providing these appliances at a cost that patients
5 would find acceptable. Approximately a year ago, we became
6 aware of an appliance called the Snore Ban made of the same
7 material, essentially, as far as we could tell, as a
8 football player, a soccer player, or a basketball player's
9 mouthpiece and the same material that they might wear in a
10 standard mouth guard.

11 The appliances differed by having a bottom portion
12 which could hold the bottom teeth and jaw in place. The
13 device was provided to us at a negotiated price of \$17 per
14 unit. Whenever we didn't give them away, we essentially
15 charged patients \$50 which was essentially covering all our
16 costs.

17 We did a little study on this and I have data that
18 I want to present, but before I do that, I would like to
19 point out that, number one, I am here not at the
20 representation of any group other than the Tristate Sleep
21 Disorder Center of which I am the director.

22 We have not done any work for any company that
23 manufactures these dental appliances. We have not been
24 paid--let me put it this way; we have not been paid to do

1 any work by any company that manufacturers these appliances
2 nor do we have any financial relationship with any company
3 that makes this including the company that makes the Snore
4 Ban.

5 Indeed, I have never even met the individuals that
6 are involved. Let me also say that I have no training--
7 neither do I nor does Dr. David Berkowitz, our medical
8 director, have any formal training in dentistry or, I should
9 add, in the law which maybe I need to be more concerned
10 about than dentistry.

11 We have been uncomfortable with providing these
12 appliances but we felt the need to make them available
13 because of the pressure that we were getting from patients.
14 So we found that patients who have clinically significant
15 levels of sleep apnea--we first tried them on nasal CPAP as
16 a gold standard to determine the degree to which resolving
17 their apnea improved their condition.

18 Then, those not happy with nightly CPAP use, or
19 unwilling to comply, were provided with the Snore Ban. A
20 number of these were asked to return to the lab for a
21 polysomnographic reevaluation with the appliance in place.
22 Neither the patients nor the third party were charged a fee
23 for carrying out this study.

24 I have some data that I would like to share with

1 you. This is the data from a pilot study that we carried
2 out. Let me just simply describe that with the nine
3 patients, these were patients who had a respiratory-
4 disturbance index--that is, the frequency in which their
5 airway closed fully or partially--of slightly over 18
6 episodes per hour which is considered clinically
7 significant.

8 We use standard techniques. We are talking about
9 events that last at least ten seconds and events that are
10 associated with at least a 4 percent drop in oxygen
11 saturation.

12 Using the Snore Ban, the respiratory-disturbance
13 index for the one night that was evaluated was reduced to
14 approximately five episodes per hour which is considered by
15 clinicians to be the upper limit of normal. This was
16 statistically significant. Clearly, in these individuals,
17 the Snore Ban was reducing the degree of sleep apnea.

18 From a subjective standpoint, in terms of snoring,
19 the patients did not have as severe a problem with snoring
20 and we intentionally selected patients that did not have
21 severe sleep apnea. There was a reduction. Subjectively,
22 patients report at home that there is an improvement. We
23 hear this on a regular basis from their spouse or bed
24 partner, if they are the same, that there is a clinical

1 improvement.

2 Similarly, there was an improvement in the lowest
3 oxygen saturation. That was the only other statistically
4 significant finding. A lot of this has to be with the
5 variability and the small n.

6 The data clearly demonstrate that the
7 effectiveness of the appliance in treating obstructive sleep
8 apnea and, indeed, many patients who, by history, seem to be
9 experiencing only snoring without witnessed apnea or
10 symptoms of sleep apnea, who were not part of the study,
11 reported improvement in their snoring.

12 We remain quite impressed with these appliances
13 which, while clearly not as effective as CPAP, and that is
14 important, they do seem to improve snoring and obstructive
15 sleep apnea for many patients. However, as we have learned
16 many times in the past, while the laboratory is the best
17 place to learn about efficacy, the marketplace is where we
18 really learn about adverse events.

19 Patients that we have treated with this particular
20 appliance, and I have no reason to believe that we would see
21 anything different with others and we have used others,
22 began to complain of tightness in the condyle area that
23 often didn't dissipate for hours after awakening. We were
24 told that this was simply fluid buildup in the open joint

1 but our concerns regarding creating a TMJ type of problem
2 were unsettling.

3 Other patients described tooth pain with one
4 patient saying, "I was unable to bite into a bagel until
5 noon." I would tell you that that bagel in Cincinnati is
6 among the best in the country so that is a difficult
7 problem.

8 But, at any rate, patients complained about a
9 change in their bite, teeth that moved, soreness in their
10 gums. This occurred independent of the degree to which we
11 advanced the jaw and, indeed, for most patients, we simply
12 recommended that the appliance be fitted with the upper and
13 lower teeth in a neutral or meeting position.

14 These problems do not change the fact that the
15 dental appliances have an important and yet still
16 unfulfilled role to play in the management of snoring and
17 apnea. However, given their potential side effects and the
18 likelihood that many patients would be undertreated for more
19 sleep apnea and a lack of appreciation by the risks that
20 occur with long-term use, we can't support their use without
21 the involvement of a knowledgeable clinician.

22 While we are excited and encouraged by the
23 prospects of an inexpensive treatment for both snoring and
24 sleep apnea, our recommendation is to encourage clinician

1 involvement in their use.

2 I didn't get the agenda for today until today and,
3 as a result, I am not sure that I addressed any of the
4 important issues that are before this committee. In
5 reviewing this, I might add that one of the major concerns
6 that we have in using a dental appliance is the fact that
7 they need to have a patent nasal airway.

8 What our experience is--granted, there are
9 appliances that have a hole where patients can breathe
10 through, the one that we used did not have a hole. As a
11 result of that, it became quite obvious that if the patient
12 did not have a patent nasal airway, they were going to run
13 into some problems.

14 It is certainly a concern that presents when one
15 is dealing with a one-piece design without a breathing slot
16 or a space. We have yet to come across or test a device
17 that works in people who are edentulous. There are an awful
18 lot of people out there who either have partials or some
19 artificial teeth or are edentulous.

20 I guess, again, we believe that there is a very
21 exciting role for these appliances, but I guess I would have
22 a lot of concern about somebody just walking up to a shelf
23 and treating their sleep apnea on their own.

24 Thank you very much.

1 DR. GENCO: Thank you very much, Dr. Scharf.

2 Any comments or questions from the panel?

3 DR. PATTERS: Dr. Scharf, we received some
4 information, the panel did, from a Dr. Hillson. He listed a
5 device called Snore Ban under the category of illegally
6 marketed devices. Is this the same device that you use, do
7 you know?

8 DR. SCHARF: My assumption is that that is
9 correct. I can't tell you exactly how we found this. It
10 was advertised somewhere in one of the sleep journals. We
11 contacted these people and they negotiated a price for us
12 and sent them to us. We get them by the case and have been
13 using them.

14 DR. PATTERS: I am not asking you to admit to
15 admit to any crimes here. But, just, do you think it is the
16 same device.

17 DR. SHIRE: I might be able to clarify that for
18 you. Some things are public knowledge and the fact that the
19 this device has persisted to market without the benefit of
20 being cleared by the FDA. Recently, this is also public
21 information that the device has been seized and there is
22 some regulatory action being taken against that particular
23 company.

24 It was an unfortunate choice of a product.

1 DR. SCHARF: We had no idea that this was--

2 DR. SHIRE: Only in the sense that it hadn't been
3 cleared. The design and materials may be comparable, but
4 the fact that we haven't reviewed it means that we don't
5 know. Does that help?

6 DR. PATTERS: So you believe that it is the same
7 device and you have moved yours to some locked area where
8 they can't be--

9 DR. SCHARF: As soon as I get back.

10 DR. SHIRE: Seizure actions are against the
11 manufacturer, the sponsor of the product, not against the
12 indication users.

13 DR. FURST: Why did you intentionally choose
14 patients who had RDIs of lower than 20?

15 DR. SCHARF: That is a good question. We wanted
16 to get some experience with this first before we let anybody
17 just go home with this. At the time that we began using
18 this, we had some experience with a variety of appliances
19 that were made by different dentists in the Cincinnati area
20 and every one of them looked a little bit different. We
21 weren't really getting a lot of consistency.

22 So we felt like we were going to do a study that
23 was unfunded, that was unindemnified, that we would take
24 people who clearly had sleep apnea and who were willing to

1 come in and do this. We just didn't want to expose them to
2 any more risk.

3 DR. FURST: A couple of issues; number one, with
4 RDIs that low, I am a little surprised that the oxygen
5 saturations only went up to 85 percent.

6 DR. SCHARF: That is another interesting thought.
7 I think that one of the shortcomings that we experience in
8 the sleep lab is the fact that a diagnostic night is a
9 single night and is generally, we believe, not a totally
10 representative night.

11 We are limited by reimbursement issues. I tell
12 the patients, "Look, unless your wife puts wires on you
13 before you go to bed and belts around you, which would
14 stimulate a variety of discussions, but unless that is
15 happening, this is going to be a very unique experience. We
16 don't expect that you are going to sleep in the lab like you
17 do at home."

18 So we generally assume that we are
19 underestimating. The reason I say that--

20 DR. FURST: What is your routine diagnostic study?
21 One night; right?

22 DR. SCHARF: It is one night. What generally
23 happens is that positive results are pretty easy to deal
24 with. Negative results are a problem. In the 15 to

1 20 percent of the patients who have a history strongly
2 suggestive of sleep apnea who come into the lab and hardly
3 make a sound, we repeat that study at home at our expense.
4 In over 50 percent of the cases, we come up with some pretty
5 dramatic numbers.

6 So we think that if anybody were to do a formal
7 study, a good study, it should require a series of
8 consecutive nights under each condition. Clearly, all we
9 were demonstrating is (a), that it seemed to work, it was
10 consistent with reports from other devices that Dr. Schmidt-
11 Nowarra has published, consistent with clinical experience
12 and consistent with what the patients tell us.

13 But it still makes us a little nervous that people
14 would do this on their own, and especially the side effects.

15 DR. FURST: Your side effects seem to be
16 exceedingly high.

17 DR. SCHARF: The side effects are not necessarily
18 exceedingly high because I haven't given any numbers on what
19 percentage of the patients have this. My assumption is that
20 the side effects could be tempered somewhat by the skill of
21 the clinician. I am not a dentist and, in this case, we
22 have the patients fitting themselves--it just so happens
23 that this device is essentially fit by themselves.

24 The reality is that, in those instances where we

1 were to fit the patient in the laboratory, I am not sure
2 that we, as non-dentists, would do, necessarily, a better
3 job. However, I have had many patients come to us who have
4 been fit by dentists who had undergone a variety of courses
5 who still experience the exact same symptoms.

6 So I am not sure how much of this is just the fact
7 that some patients have a problem with moving their jaw.
8 The majority of my experience is in the area of the
9 pharmacology of sleep. I will tell you unequivocally that
10 the percentage of patients who have side effects from the
11 dental appliance is much higher than the percentage of
12 patients that I see who are treated with an experimental
13 hypnotic.

14 DR. GENCO: Any further questions or comments of
15 Dr. Scharf?

16 Thank you very much, Dr. Scharf.

17 DR. SCHARF: Thank you.

18 DR. GENCO: Is there anybody else from the public
19 who wants to speak? If not, I would like to ask Dr. Sandra
20 Shire to give us some orientation. Dr. Shire is a dental
21 officer with the Dental Devices Branch. She is going to
22 make a presentation relative to intraoral appliances for
23 treatment of obstructive sleep apnea and snoring.

24

FDA Presentation

1 DR. SHIRE: Thank you, DR. GENCO. This is the
2 classification of the intraoral appliances for treatment of
3 snoring and sleep apnea. Intraoral appliances for the
4 treatment of snoring and sleep apnea are currently
5 unclassified. We are asking the panel to determine an
6 appropriate classification for these devices.

7 In the context of classification, there are
8 certain issues related to the use of these products that we
9 would like the panel to consider. Dr. Scharf touched on a
10 few of them and they will be presented in the form of
11 questions at the end of my presentation.

12 Snoring is both a social and medical problem.
13 Heavy snorers and those who suffer from obstructive sleep
14 apnea are more prone to cardiovascular disease than their
15 non-snoring counterparts. The most advanced stage of
16 snoring is obstructive sleep apnea which can cause cardiac,
17 pulmonary and behavior problems.

18 Whereas snoring means a partial obstruction of the
19 airway, apnea means total obstruction. Occasional brief
20 obstructive events are harmless and quite common in the
21 adult population. It is considered a pathological condition
22 when the apnea episodes last over ten seconds each and occur
23 seven to ten times per hour.

24 In many apnea patients, episodes last over 30

1 seconds each and occur hundreds of time during a night.
2 Such patients may spend half of their sleep time in total
3 airway obstruction.

4 The literature indicates that significant apnea
5 may occur in 35 percent of snorers. Traditional therapeutic
6 modalities for the treatment of snoring and sleep apnea
7 includes surgical and medical approaches. The increasing
8 availability of intraoral appliances provides another option
9 for practitioners who would like to avoid surgery or CPAP
10 treatment or who feel that the patient is unlikely to adopt
11 or benefit from significant lifestyle changes that would
12 improve their condition. Oral appliance therapy offers a
13 noninvasive and reversible treatment option.

14 FDA review of these intraoral appliances is
15 required prior to marketing. Intraoral devices are reviewed
16 in the Dental Devices Branch under the Premarket
17 Notification, or 510(k) Program. Reviewers examine the
18 device's extent of claims and have consistently required
19 prescription labeling; that is, that these devices be
20 dispensed under the supervision of a dentist or a physician.

21 For devices that seek to claim treatment for
22 obstructive sleep apnea, the Dental Branch also recommends
23 that the sponsor submit clinical data to support safe and
24 efficacious use of the device. We do have the opportunity

1 to request clinical data in a 510(k), and this is one
2 situation where we have done so.

3 Many intraoral devices have been cleared for
4 market. These devices fall into three categories. The
5 categories are mandibular-repositioning devices, tongue-
6 retaining devices, and palatal-lifting devices. The
7 majority of the devices that we have cleared have been of
8 the mandibular-positioning type but there have been a
9 handful of tongue-retaining devices and palatal-lifting
10 devices.

11 The mandibular-positioning devices are designed to
12 move the mandible into a more anterior position and provide
13 support for the jaw at rest. This is intended to create a
14 larger airspace thereby increasing the air turbulence and
15 tissue vibration responsible for snoring.

16 Tongue-retaining devices are intended to increase
17 airway patency by supporting the tongue in an anterior
18 position and palatal-lifting devices are designed to lift
19 the soft palate thereby creating a larger airways space.

20 The Dental Branch has considered these devices to
21 be appropriate for prescription dispensing because of the
22 possibility of misdiagnosis of a more serious condition. In
23 addition, musculoskeletal problems may occur when lay
24 persons attempt to advance and support the mandible in a

1 forward position.

2 Resulting pain or injury to the temporomandibular
3 joint or other orofacial structures or, if you were here on
4 Monday, the maxillary-trigeminal complex--if the mandible is
5 advanced too far or too rapidly.

6 The panel will be asked to evaluate whether
7 prescription labeling will be appropriate and what factors
8 should be considered if over-the-counter availability for
9 these products is considered. The panel should also
10 consider any special labeling considerations such as
11 precautions or contraindications.

12 If you can stand it, I would like to provide one
13 more iteration of device classification for you. Regulatory
14 classification of medical devices is assigned by the
15 relative risk of the device and the level of control
16 necessary to help insure safety and effectiveness of the
17 device.

18 Class I devices are required to meet general
19 controls. General controls are the baseline requirements
20 for all medical devices. These related to misbranding,
21 adulteration and, unless exempted, registration and listing
22 submission of PMNs at the 510(k) and design and production
23 of the devices under good manufacturing practices.

24 Class II devices are required to meet general

1 controls and also special controls. These are further regs
2 and may include special labeling requirements, patient
3 registries, post-market surveillances. Class I and class II
4 devices are cleared with a 510(k) and this requires
5 demonstration that the proposed product is as safe and as
6 effective as a legally marketed device.

7 Premarket approval is the process for FDA to
8 evaluate the safety and effectiveness for class II devices.
9 This is the most stringent level of control for a new
10 product. Due to the level of risk, the agency has
11 determined that general and special controls for the
12 class II product would not suffice for the regulation of
13 that particular product.

14 Please consider the following questions during
15 your discussion of intraoral devices for the treatment of
16 snoring and sleep apnea.

17 [Slide.]

18 Question 1; should the agency continue to consider
19 all three types of intraoral appliances for snoring and
20 sleep apnea--that is, mandibular repositioners, tongue-
21 retaining devices and palatal lifters as one category for
22 the purpose of classification. If not, what features of a
23 device would cause it to fall into a different category.

24 That is the lump or split question.

1 [Slide.]

2 Question 2. This is in three parts. In the
3 context of classification and the possibilities for special
4 controls, please address the following issues in your
5 discussions: design features--intraoral mandibular-
6 positioning devices are either of a one-piece or a two-piece
7 design. Devices that are of a two-piece design are
8 connected together by various mechanical means and can be
9 separated by the patient in the case of an emergency.

10 One-piece designs generally include slots or
11 spaces to permit oral breathing. What concerns might be
12 presented by a one-piece design without breathing slots or
13 spaces?

14 Section 2 is precautions or risks. Same question.
15 Are there special instructions or contraindications that the
16 panel can identify related to the use of the devices in
17 patients who wear full or partial removable dentures? Are
18 there other precautions or warnings that could be included
19 in the device labeling?

20 The third part of that question; intraoral devices
21 for the treatment of snoring and sleep apnea have been
22 cleared for market as prescription devices. For this
23 category of devices, would the classification be the same if
24 the products were dispensed as over-the-counter products?

1 [Slide.]

2 Third question. Should the agency require the
3 sponsors of intraoral devices that claim to treat sleep
4 apnea to submit clinical data to support that claim? If so,
5 please describe the pertinent features for such studies.

6 DR. GENCO: Thank you very much, Dr. Shire.

7 Any questions of Dr. Shire from the panel?

8 If not, what we will do then is proceed with the
9 presentations by Dr. Berman. I think we might have time for
10 the other two, also. Dr. Charles Berman.

11 **Presentations by Professional Organizations**

12 DR. BERMAN: All of you have a presentation by Dr.
13 Kenneth Hillson before you. I should explain the occasion
14 of my being here. I am his patient. He could not come
15 today. There was absolutely no way that he could come and
16 he would asked me if I would pinch hit for him. So I will
17 ask you to be kind to me and I will do my best to prevent
18 his views.

19 I have spent quite a bit of time with him. He
20 made me a snoring device many, many years ago which clearly
21 works. I am reasonably familiar with the work that he has
22 done over the last number of years. I also have made a few,
23 perhaps ten, snoring devices in my own practice. They were
24 all prescriptive, not in the form of my purchasing but in

1 the form of fabricating my own device.

2 In some of the patients, we made appliances for
3 people who could not wear CPAP devices. Interestingly
4 enough, these were not referred by the local sleep center
5 which, in our hospital, does not use dental intraoral
6 appliances.

7 As I was sitting here, ladies and gentleman, I was
8 reminded of a Sunday morning when we were driving to play
9 golf and we saw a fire in a farmhouse. My friends and I
10 stopped and began to put out the fire with garden hoses and
11 went into the building and got people out of the building.

12 There were people there who were saying, "Wait for
13 the fire department." The analogy that I am making is a
14 very interesting one because it has been proposed here that
15 the best for the public, the public's health interest, at
16 this moment, is, perhaps, to classify devices all as
17 class II.

18 I wonder about that. I really do because you know
19 it wasn't but a few years ago when dentists didn't measure
20 blood pressures. I know very well about that time because I
21 pioneered the public-health effort to get dentists to
22 measure blood pressures. We brought in, by 1980, over
23 800,000 people into medical care and there was a fire with
24 high blood pressure, no doubt about it. The fire is not

1 nearly as bad today.

2 I am going to suggest to you that you classify
3 snoring devices, labeled only for snoring, as class I, that
4 you make it as easy as possible to get snoring devices on
5 the market, labeled only for snoring. The reason for that
6 is that it gives the trucker who is falling asleep at the
7 wheel--and, incidently, have any of you been bumped going 60
8 miles an hour on the expressway by a driver who rammed you
9 up the back because he fell asleep? Well, I have.

10 Have any of you ever been in a car accident
11 because you fell asleep? Well, I think I have. I am not
12 sure because I don't remember. So there is a real public-
13 health problem of people falling asleep during the day. And
14 there is a lack of information out there, as we had in 1974,
15 when high blood pressure was rising, the cardiovascular
16 death rate was rising.

17 Interestingly enough, the cardiovascular death
18 rate peaked in 1974 precisely when the National High Blood
19 Pressure Education Program came into effect and I was their
20 first dental consultant.

21 So you have really got a "conscience" decision
22 here to make. You have got a really difficult decision to
23 make. Those of you who are professional sleep people, of
24 course, you are going to see it from your side. But I am a

1 patient. I am a guy who probably had an accident because he
2 fell asleep.

3 I didn't kill anybody but I tell you, I have just
4 made an appliance for a young man who totalled two cars in
5 the last two years; big fat neck, classical anatomy of a
6 snorer, overweight, no exercise. He came in the following
7 week and said, "Unbelievable. I'm sleeping. I'm better. I
8 feel wonderful."

9 You are shaking your head. It's okay. You don't
10 like it. Fine. I'm giving it to you. You should know and
11 you will make your decision but I think you have to give
12 very serious thought to making it difficult to bring snoring
13 appliances to market.

14 Sleep apnea appliances, fine. Where there are
15 medical claims, fine. But there are hundreds of thousands
16 of car accidents a year related to daytime sleep.

17 I think that sums it up pretty well. I think you
18 have got a "conscience" decision to make. Are you going to
19 make it easy to bring snoring devices to market--snoring
20 devices.

21 DR. GENCO: Thank you very much, Dr. Berman.

22 Panel, do you have any questions or comments?

23 DR. PATTERS: Dr. Berman, could you clarify what
24 you mean by "making it easy?" You have made these devices

1 for others, worn them as made by other professionals. Are
2 you suggesting that a patient go into the drugstore and buy
3 their own and fit themselves?

4 DR. BERMAN: Maybe. Maybe I am. It is possible
5 that I am because I think the worst that is going to happen
6 is that he is going to take it out and throw it out as some
7 of my patients have done on the appliances I have made. But
8 that said, yes. I think the worst that is going to happen--
9 this is a noninvasive procedure. This is not like
10 uvulectomies. This is not like pharyngeal surgery.

11 This is not like a \$5,000 sleep study. The
12 country can't afford that. You know that. And there is a
13 fire. Are you going to wait for the fire department or are
14 you going to do something about it?

15 DR. GENCO: Any further comments from the panel or
16 the guests?

17 DR. FURST: I would like to know what you would do
18 with that trucker who had really severe sleep apnea with
19 desaturations and a respiratory index of 60 who doesn't know
20 he has sleep apnea but just knows he snores. He goes to a
21 store and he buys a snoring device. He snores better but he
22 still has sleep apnea and still falls asleep at the wheel.

23 How do you justify that?

24 DR. BERMAN: You are going to have an accident

1 either way. You know that and I know that. He may kill
2 you. But the fact of the matter is yes. The fact of the
3 matter is, by the fact that he goes out and buys something
4 off the counter gives you a chance to educate him, gives you
5 a chance to put this in his head, gives you a chance, with
6 labeling--gives the country a chance to market high blood
7 pressure.

8 The same way. Don't monkey around with it.

9 DR. CLARK: I just thought I would point out that
10 if somebody falls asleep at the wheel, it is not usually
11 because of snoring.

12 DR. BERMAN: Pardon me. I can't hear you.

13 DR. CLARK: If somebody falls asleep driving a
14 car, it is not because of snoring. It is because of apnea.
15 You seem to mix the two together. I just wanted to clarify
16 that point.

17 DR. BERMAN: But people who have apnea snore. It
18 gives you shot at them that you didn't have before. It is
19 like the patient going to a dentist with a toothache and you
20 find out he has got a systolic blood pressure of 200 and a
21 diastolic blood pressure of 120 and you get him into medical
22 care. That has happened to me lots.

23 It gives you a shot at him.

24 DR. HEFFEZ: Does an anti-snoring device prevent

1 somebody from sleeping?

2 DR. BERMAN: Not me. Not at all. Also, one of
3 the things that you are going to do is stimulate invention.
4 Just think about that for a minute. You are going to
5 stimulate more invention. You are going to stimulate more
6 creativity. There is a way of doing it so that the patient
7 can adjust the anterior/posterior dimension. There is a way
8 of doing that which I have seen.

9 There is literally a way a patient can make them
10 themselves. Let the person prove to the FDA that this is
11 all possible but make it easier. Don't wait until the house
12 burns down.

13 DR. HENDLER: Just one comment. It seems to me
14 that that approach takes this patient's care out of the
15 hands of professionals who could help diagnose a sleep-apnea
16 problem and potentially lure a patient into a false sense of
17 security. They may not be snoring anymore, but they may be
18 having significant life-threatening sleep apnea as well.

19 Patients who are not snoring, many of them, and I
20 have seen many patients like this, feel they don't need to
21 see anybody now. Their wife is no longer bashing them in
22 the side to wake them up in the middle of the night. But
23 they are still having sleep apnea.

24 DR. FURST: It is one of the reasons that laser

1 uvulopalatoplasty is contraindicated in patients who have
2 sleep apnea because, very often, their bed partner will see
3 their witnessed apnea as a reason for them to seek medical
4 care. If you remove that snore and they can't witness the
5 apnea, then the patients can continue to have apnea and not
6 snore. That is a very potentially dangerous problem.

7 DR. GENCO: Any further comments?

8 DR. BERMAN: I have no comments. Thank you so
9 much for having me.

10 DR. GENCO: You are welcome. Thank you.

11 Shall we proceed, then, to the next speaker from
12 the American Sleep Disorders Organization, Dr. Daniel Loube.

13 DR. LOUBE: I am Dan Loube. I am the head of the
14 Sleep Disorder Breathing Special Interest Section of the
15 American Sleep Disorders Association.

16 [Slide.]

17 The American Sleep Disorders Association is 3,000
18 physician member strong. The ASDA sets the standards for
19 sleep medicine practice in country. It publishes practice
20 parameters and position statements. It accredits all the
21 sleep centers and the sleep laboratories in the country.

22 There is also an American Board of Sleep Medicine
23 that credentials and certifies indication sleep
24 practitioners. All of this is in an effort to standardize

1 the practice of sleep disorders medicine.

2 [Slide.]

3 I think all of you know that sleep apnea is
4 dangerous. Some of sequelae of obstructive sleep apnea
5 include hypertension, coronary-artery disease,
6 hyperglycemia, stroke, pulmonary hypertension and some
7 neuropsychiatric problems such as depression, mentation
8 changes and some other problems.

9 [Slide.]

10 Work by Larry Finley at the University of Virginia
11 has demonstrated that patients with obstructive sleep apnea
12 are at increased risk for accidents, as you all know.
13 Certainly, patients with severe apnea are at least two and a
14 half times increased risk versus all drivers for having
15 accidents.

16 The main problem right now with sleep apnea is
17 that it is inadequately diagnosed and it is inadequately
18 treated. There is a problem with standardization. Part of
19 that problem is that patients are underdiagnosed. A
20 possible mechanism for underdiagnosing patients would be if
21 they went to a drug store and bought a device for snoring
22 when what they had was either obstructive sleep apnea or
23 upper airway resistance syndrome.

24 Other problems with the diagnosis of these

1 patients are that they can be misdiagnosed. That might
2 occur when they go to a physician or a dentist who is not
3 experienced with these disorders. Potentially, they may
4 present with excessive daytime sleepiness but not have
5 obstructive sleep apnea.

6 They might have nocturnal oxygen desaturation that
7 occurs with COPD. They might have nocturnal oxygen
8 desaturation which occurs with neuromuscular weakness from
9 some neuromuscular diseases. They might have central sleep
10 apnea which is not a problem of obstruction of the pharynx
11 but more a problem of central drive leading to lack of
12 breathing during sleep.

13 There are a number of compliance problems that we
14 are dealing with right now when we are trying to treat
15 adequately obstructive sleep apnea patients. We only have
16 between a 50 to 75 percent compliance rate when we use CPAP.
17 We think the compliance rate may be higher with oral
18 appliances, but we are not sure because all we have is
19 subjective data.

20 We also have a problem in that we have learned
21 that subjective treatment responses, when we are assessing
22 treatment outcomes, are inadequate to assess whether or not
23 a treatment works. So if a patient has gotten an oral
24 appliance or has gotten upper-airway surgery--let's say a

1 laser-assisted uvuloplasty or something else, they may say
2 they feel better but, in actuality, they may be still having
3 35 or 50 or 60 obstructive sleep apnea events per hour.

4 Finally, we have a problem with getting patients
5 back for follow up. This is in addition to getting patients
6 initially in to the physician; we have a problem with
7 getting them back for follow up. We have a problem with
8 getting them back for follow-up sleep studies to document
9 the success or the failure of these different treatments.

10 [Slide.]

11 This is a compilation of some of the recent
12 studies on oral appliance outcomes. The Y axis represents
13 respiratory disturbance index and on the X axis are a number
14 of the authors who have authored these studies.

15 What you see with the yellow bars is that the
16 respiratory index is high and, with the blue bars, that,
17 after treatment, the RDIs significantly decrease.

18 Respiratory disturbance index, or the number of apnea and
19 hypopneas per hour.

20 So oral appliances work with respect to decreasing
21 the respiratory index when we use certain types of
22 mandibular-repositioning devices. Unfortunately, now, if
23 you look at lowest nocturnal oxygen saturation, again yellow
24 pretreatment and blue posttreatment, we see an improvement

1 in the lowest nocturnal oxygen saturation but we don't see
2 patients going back up above 90 percent lowest nocturnal
3 oxygen saturation.

4 So there is a suggestion there for patients who
5 have problems with oxygen saturation during their
6 obstructive sleep apnea that oral appliances may not be the
7 best treatment.

8 [Slide.]

9 This is some data from a study that was published
10 in Sleep that looked at the respiratory disturbance index
11 pre- and post-treatment with the mandibular-positioning
12 device. What you see is that some patients, post treatment,
13 who start off with an RDI of less than about 30, have a
14 pretty good treatment response but that the respiratory
15 disturbance index is never completely reduced to zero as it
16 might be with CPAP.

17 As well, if you look at the patients who have more
18 significant or more severe sleep apnea up here with an RDI
19 that is above 40, you see some of them fail. And some of
20 them don't really have adequate treatment responses. They
21 only get down to a rate of about 20 events per hour which
22 means that they still have sleep apnea that has significant
23 mortality attached to it.

24 [Slide.]

1 The American Sleep Disorders Association came up
2 with practice parameters and that is that, for mild
3 obstructive sleep apnea, oral appliances can be a first-line
4 treatment. For severe obstructive sleep apnea, oral
5 appliances should only be used if patients are CPAP-
6 intolerant.

7 Then, for moderate obstructive sleep apnea, the
8 American Sleep Disorders Association still thinks that this
9 is a second-line treatment, but I think that some of the
10 newer data that has come out the past year and a half
11 suggests that increased efficacy may allow for more
12 widespread use of oral appliances in moderate patients.

13 The bottom line is, and I think what is important
14 to say to you all, is that the use of oral appliances or a
15 application of this to the treatment of obstructive sleep
16 apnea is not perfected by any means.

17 [Slide.]

18 Some devices fail. There is a device called
19 Snore-Ex. This was evaluated in an article that was
20 published recently in the American Journal of Respiratory
21 and Critical-Care Medicine. This device had a very high
22 failure rate and a very poor compliance rate.

23 So not all these devices are created equal. A lot
24 of these devices don't work. And there are some other

1 issues.

2 [Slide.]

3 Side effects are frequent. There was an article
4 published in the Sleep Disorders Dental Society this past
5 issue, the report, that suggests a 25 percent side-effect
6 prevalence and these included teeth pain, jaw pain, gum pain
7 and TMJ discomfort or pain, excessive salivation, et cetera.
8 So there are a number of side effects that occur with oral
9 appliances.

10 [Slide.]

11 Possibly even more importantly, we don't know what
12 the long-term side effects of oral appliances are.

13 [Slide.]

14 With respect to how these devices should be
15 dispensed, I think that, in a sense, oral appliances have a
16 potency that is equal to CPAP on some occasions and to some
17 of the medicines that are out on the market. I think we
18 should treat it with the same type of respect that we do to
19 prescription medicines that are rigorously evaluated by the
20 FDA before they are put on the market and whose side effect
21 profile is very carefully assessed.

22 I think that it is very, very important to keep
23 dentists and doctors in the loop, and this will be lost if
24 we make these devices class I or, in a sense, over-the-

1 counter.

2 [Slide.]

3 When I speak to pulmonologists, I think the bottom
4 line is that oral appliances are ready for integration into
5 our armamentarium for the treatment of obstructive sleep
6 apnea. However, they are not yet perfected and there needs
7 to be considerable more work before we can say that all
8 devices work and that we can predict which devices work for
9 individual patients.

10 Thank you.

11 Dr. GENCO: Thank you, Dr. Loube.

12 Any comments or questions from the panel?

13 Dr. Loube, in the data that you showed with
14 respect to RDI and oxygen saturation, were those the
15 mandibular repositioning devices or a mixture of devices?

16 DR. LOUBE: Those were four studies on mandibular-
17 repositioning devices. Those were studies that got
18 published. Those were good outcomes. There are studies
19 that the outcomes are not as good and there are devices on
20 the market where the outcomes are not quite as good.

21 DR. GENCO: Mandibular-positioning devices is not
22 as good. As that what you are saying?

23 DR. LOUBE: I, personally, think that mandibular-
24 positioning devices have been better evaluated. There have

1 been few studies over the past ten years on tongue-retaining
2 devices and I would hope that we would start to do more of
3 those studies. But I, personally, don't frequently use
4 tongue-retaining devices in my practice.

5 DR. GENCO: What is the Snore-Ex?

6 DR. LOUBE: The Snore-Ex is a palatal lifter.

7 DR. GENCO: Are there studies with palatal
8 lifters?

9 DR. LOUBE: Other studies with palatal lifters? I
10 would have to defer to a dentist's expertise. I had not
11 seen much in my review of the literature.

12 DR. FURST: There are virtually no studies on
13 palatal lifters at all.

14 DR. GENCO: Any other comments or questions from
15 the panel or the guests of Dr. Loube?

16 DR. LOUBE: Thanks.

17 DR. GENCO: Thank you very much.

18 Let's now hear from Dr. Dennis Bailey, of the
19 Sleep Disorders Dental Society.

20 DR. BAILEY: May I have two minutes to go and get
21 my slides? I wasn't prepared until tomorrow.

22 DR. GENCO: We could defer that until tomorrow.
23 You are right. You were scheduled for tomorrow.

24 That ends our formal presentations. It is a

1 quarter to 5:00. We could have some discussion now or would
2 you like to have discussion after finishing the formal
3 presentations tomorrow. We have, actually, a series of four
4 presentations tomorrow.

5 What would you like to do? Wait until tomorrow?

6 DR. DRUMMOND: I would like the presentation of
7 the general field before we discuss what we are doing.

8 DR. GENCO: Okay.

9 DR. ALTMAN: Are the presentations tomorrow all
10 from industry or are they professional organizations?

11 DR. GENCO: Dr. Bailey, is yours an organization
12 or industry.

13 DR. BAILEY: Yes, sir. I represent the Sleep
14 Disorders Dental Society.

15 DR. GENCO: So that is an organization. The last
16 two, EMP Systems, Dr. Burton, and a representative of DISTAR
17 are apparently companies.

18 Sandra, would you like us to deal with anything
19 more tonight or wait until the presentations tomorrow.

20 DR. SHIRE: No; the charge is clear to the panel.

21 DR. GENCO: The charge is clear. We are starting
22 to hear some information relative to some of your questions.

23 If that is the case, the meeting is formally
24 adjourned for the day. I would suggest we take a ten-minute

1 break and then we will come back here for closed session.

2 [Whereupon, at 4:40 p.m., the proceedings were

3 recessed, to be resumed at 8 o'clock a.m., Wednesday,

4 November 5, 1997.]