

DEPARTMENT OF HEALTH AND HUMAN SERVICES

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PUBLIC HEALTH SERVICE

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MEDICAL DEVICES ADVISORY COMMITTEE

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ORTHOPEDICS AND REHABILITATION DEVICES
ADVISORY PANEL MEETING

+ + + + +

Thursday,
November 4, 1999

The meeting was held in Room 020B of the Center For Devices and Radiological Health, 9200 Corporate Boulevard, Rockville, Maryland 20850, Dr. Michael J. Yaszemski, Acting Panel Chair, presiding.

PRESENT:

- MICHAEL J. YASZEMSKI, M.D., Ph.D., Acting Panel Chair
- ALBERT ABOULAFIA, M.D., Voting Member
- MARCUS P. BESSER, Ph.D., Approved Consultant
- EDWARD Y. CHENG, M.D., Voting Member
- BLAKE HANNAFORD, Ph.D., Approved Consultant
- KINLEY LARNTZ, Ph.D., Approved Consultant
- CATO T. LAURENCIN, M.D., Ph.D., Voting Member
- RAYMOND SILKAITIS, Ph.D., Industry Representative
- HARRY B. SKINNER, M.D., Ph.D., Voting Member
- CEDRIC WALKER, Ph.D., P.E., Approved Consultant

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FDA PARTICIPANTS:

HANY DEMIAN, M.S., Panel Executive Secretary

JIM DILLARD, M.S.

JOHN GOODE, M.S.

THOMAS P. GROSS, M.D. M.P.H.

MARK MELKERSON, M.S.

NEIL OGDEN, M.S.

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

2 (9:06 a.m.)

3 MR. DEMIAN: Good morning, everyone.
4 We're ready to begin the meeting of the Orthopedic
5 and Rehabilitation Device Advisory Panel.

6 My name is Hany Demian and I'm the
7 Executive Secretary of this panel, and I'm a Senior
8 Scientific Reviewer in the Orthopedics Devices
9 Branch.

10 I would like to remind everybody that
11 you're requested to sign in on the attendance
12 sheets at the tables by the door. You may also
13 pick up an agenda and information about today's
14 meeting, including how to find out about future
15 meeting dates and how to obtain meeting minutes or
16 transcripts.

17 I will now read two statements that are
18 required to be read into the record, the
19 Deputization of Temporary Voting Members Statement
20 and the Conflict of Interest Statement.

21 Pursuant to the authority granted under
22 the Medical Devices Advisory Committee charter

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1 dated October 27, 1990, as amended April 20, '95, I
2 appoint the following members for the Orthopedic
3 and Rehabilitation Devices Panel for this meeting
4 on November 4, '99: Marcus Besser, Blake
5 Hannaford, Kinley Larntz and Cedric Walker.

6 For the record, these people are special
7 Government employees and are consultants to the
8 panel under the Medical Device Advisory Committee.

9 They have undergone the customary conflict of
10 interest review and have reviewed the material to
11 be considered at this meeting. And this is signed
12 David Feigal.

13 Conflict of interest statement. The
14 following announcement addresses conflict of
15 interest issues associated with this meeting and is
16 made part of the record to preclude even the
17 appearance of any impropriety.

18 To determine if any conflicts existed,
19 the Agency reviewed the submitted agenda for this
20 meeting and all financial interests reported by
21 committee participants. The conflict of interest
22 statutes prohibit special Government employees from

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1 participating in matters that could affect their or
2 their employers' financial interest.

3 However, the Agency has determined that
4 participation of certain members and consultants,
5 the need for whose services outweigh the potential
6 conflict of interest involved, is in the best
7 interest of the Government.

8 Therefore, waivers have been granted for
9 Drs. Harry Skinner, Cato Laurencin, Kinley Larntz
10 for their interest in firms that could potentially
11 be affected by the panel's recommendation. Copies
12 of these waivers may be obtained from the Agency's
13 Freedom of Information Office, Room 12A-15 of the
14 Parklawn Building.

15 We would like to note for the record
16 that the Agency took into consideration other
17 matters regarding Drs. Edward Cheng and Michael
18 Yaszemski. Each of these panelists reported
19 financial interest in firms at issue, but in
20 matters that are unrelated to today's agenda.

21 The Agency has determined, therefore,
22 that they may participate fully in all discussions.

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1 In the event that the discussion
2 involves any other product or firms not already on
3 the agenda for which FDA's participant has a
4 financial interest, the participant should excuse
5 him or herself from such involvement and the
6 exclusion will be noted for the record.

7 With respect to all other participants,
8 we ask, in the fairness, that all persons making
9 statements and presentations disclose any current
10 or previous financial involvement with any firms
11 whose products they may wish to comment upon.

12 Before turning this meeting over to Dr.
13 Michael Yaszemski, our Acting Panel Chair, I would
14 like to introduce our distinguished panel members
15 who are generously giving their time to help FDA in
16 matters being discussed today and other FDA staff
17 seated at the table.

18 We'll just go around the room and
19 everybody introduce themselves and give where
20 they're from and their interests. Michael?

21 DR. YASZEMSKI: I'll start. My name is
22 Michael Yaszemski. I'm an orthopedic surgeon and a

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1 chemical engineer. I work at the Mayo Clinic. My
2 interests are adult reconstruction orthopedics,
3 spine surgery on the clinical side, and
4 bioresorbable polymers for use in bone regeneration
5 on the research side.

6 DR. LAURENCIN: I'm Dr. Cato Laurencin.
7 I'm a Professor of Chemical Engineering at Drexel
8 University and Professor of Orthopedic Surgery at
9 MCP Hahnemann Medical School. Interests are in
10 drug delivery, polymeric materials, tissue
11 engineering.

12 DR. LARNTZ: Kinley Larntz, Professor
13 Emeritus, University of Minnesota. I'm an Applied
14 Statistician and my interests are experimental
15 design clinical trials.

16 DR. SKINNER: Harry Skinner. I'm
17 Professor and Chair of Orthopedic Surgery at UC-
18 Irvine and Professor of Mechanical and Aerospace
19 Engineering at the College of Engineering at UCI.
20 And my research interests are gait analysis, adult
21 joint reconstruction and finite element analysis.

22 MR. DILLARD: Jim Dillard. I'm the

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1 Acting Division Director of the Division of General
2 and Restorative Devices here in FDA, and my
3 interests are all of the devices that come before
4 this advisory committee.

5 DR. SILKAITIS: My name is Raymond
6 Silkaitis. I'm the Vice President of Regulatory
7 Affairs for Gliatech. I'm the industry
8 representative. I've been in the medical device
9 industry for 20 years in the capacity of product
10 development, research, clinical research and
11 regulatory affairs.

12 DR. WALKER: I'm Cedric Walker. I'm
13 Professor of Biomedical Engineering at Tulane
14 University and Chairman of Engineering Science. My
15 research interests are in the area of implantable
16 medical devices, particularly electronic
17 stimulation devices.

18 DR. ABOULAFIA: My name's Albert
19 Aboulafia. I'm an orthopedic surgeon with an area
20 of interest in tumor surgery and orthopedic
21 oncology. I recently left Emory in Atlanta and am
22 now at Sinai Hospital in Baltimore with the

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1 University of Maryland.

2 DR. HANNAFORD: My name is Blake
3 Hannaford. I'm a Professor of Electrical
4 Engineering at the University of Washington in
5 Seattle, and also Adjunct Professor of
6 Bioengineering and Adjunct Professor of Surgery.
7 This is the only place where all those titles are
8 relevant.

9 And I do research on human interaction
10 with robots and surgical biomechanics.

11 DR. CHENG: My name is Edward Cheng.
12 I'm an orthopedic surgeon at the University of
13 Minnesota, and my interests are in musculoskeletal
14 oncology and adult reconstructive orthopedics.

15 DR. BESSER: I'm Mark Besser. I'm at
16 Thomas Jefferson University in Department of
17 Physical Therapy. I'm a mechanical engineer.
18 Interests are in gait analysis and biomechanics.

19 MR. DEMIAN: Thank you. We have one
20 housekeeping order. I would like to inform the
21 panel that we have a new consumer representative,
22 Ms. Cheryl Gartley. She's the president of the

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1 Simon Foundation For Continnence in Ohio. However,
2 at the last minute, due to a medical condition, she
3 was unable to attend this meeting and, because of
4 such short notice, we were unable to find a
5 replacement.

6 So, at this time, I would like to turn
7 the meeting over to our chairman, Dr. Michael
8 Yaszemski.

9 DR. YASZEMSKI: Thank you, Hany.

10 Good morning. My name is Michael
11 Yaszemski. I'll be the Acting Chairman for this
12 meeting.

13 I'd like to note for the record that the
14 voting members present constitute a quorum, as
15 required by 21 CFR Part 14.

16 First, Mr. Mark Melkerson, Branch Chief
17 of the Orthopedics Devices Branch, will provide us
18 with an update from the last panel meeting.

19 MR. MELKERSON: Good morning. This is
20 Mark Melkerson, Branch Chief, Orthopedic Devices.
21 Actually, I'll be updating from the last couple of
22 panel meetings.

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1 DR. YASZEMSKI: Thank you.

2 MR. MELKERSON: As far as actions
3 regarding previous devices that have come before
4 the panel, the Norian SRS cement was approved
5 December 28, 1998. DePuy AcroMeds Lumbar I/F cage
6 with VSP spinal system was approved in February of
7 '99.

8 The Sofamor Danek, Interfix threaded
9 fusion device was also approved May 14, 1999. And
10 another reclassification petition was actually
11 signed October 14th which reclassifies polymethyl
12 methacrylate bone cement from Class II -- or into
13 Class II from Class III transitional.

14 As far as division staffing, already
15 noted. Jim Dillard is acting as our division
16 director due to a death in another division. Dr.
17 Celia Witten will be acting as Division Director
18 for Cardiovascular and Respiratory Devices. During
19 the interim, Jim Dillard will be our acting
20 Division Director.

21 As far as branch staffing in
22 orthopedics, Ms. Jodi Nashman Anderson will be the

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1 team leader for bone and joint replacements and
2 miscellaneous devices. And for osteosynthesis and
3 spinal implants, Ms. Erin Keith.

4 That ends my update. And if there's any
5 questions, I'm available.

6 Excuse me, one last -- recent 510(k)
7 clearances may be of interest to the panel. We
8 have cleared a metal-on-metal semi-constraint hip
9 prosthesis. The manufacturer is Sulzer. And we've
10 also cleared a vertebral body replacement device,
11 and that is a DePuy AcroMed product, a stackable
12 cage with supplemental fixation.

13 That ends my presentation.

14 DR. YASZEMSKI: Thank you, Mr.
15 Melkerson.

16 Seeing no questions, we'll next ask Dr.
17 Thomas Gross of the Center For Devices and
18 Radiologic Health to provide the panel with a
19 presentation regarding post market evaluations.

20 Dr. Gross.

21 DR. GROSS: Good morning. My name is
22 Tom Gross and I'm the director of the Division of

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1 Post Market Surveillance here at CDRH, and I'd like
2 to take a few minutes of your time today to talk
3 about post market evaluation.

4 We at the center think it's important
5 that the advisory panels are aware of post market
6 programs and activities since they may directly
7 affect your deliberations about a product's safety
8 and effectiveness.

9 Now, there are three key objectives for
10 this presentation. One, to describe a few of the
11 key methods of post market evaluation. Two, to
12 present challenges in accomplishing post market
13 evaluation. And three, to describe the pivotal
14 role that you play in this arena.

15 I'm not sure why that's cut off, but, in
16 any event, this title -- this slide entitled "From
17 Design to Obsolescence" depicts three key points.
18 The first point is that it depicts the natural
19 history of a medical device from design to lab
20 bench testing, clinical testing, FDA review, and,
21 importantly, post market evaluation.

22 Secondly, it presents continual feedback

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1 loops throughout this process that leads to
2 continual product improvement, and we think that
3 post market evaluation has an important part to
4 play in this process.

5 The remainder of this talk will focus on
6 three key programs in post market evaluation: the
7 MDR Program, post market surveillance under 522,
8 and post approval studies under our PMA authority.

9 And the third point that this slide makes is that
10 the clinical community and, importantly, yourselves
11 play a key role in this process of continual
12 product improvement.

13 Now, as you all know, as products are
14 released into the marketplace, questions of
15 potential public health interest may arise. They
16 may be related to a product's long term safety,
17 about a performance of the device in community
18 practice as it moves outside the narrow confines of
19 clinical trials into general community use.

20 There may be concerns about effects of
21 changes in user setting, such as moving from
22 professional to home use; concerns about effects of

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1 changes in technology; and also concerns about
2 adverse events or patterns of adverse events.

3 Now let's talk about some of these
4 programs that may address some of those issues,
5 starting with the Medical Device Reporting Program,
6 or MDR. Now MDR is a nationwide passive
7 surveillance system of voluntary and mandatory
8 reporting.

9 Voluntary reporting started in 1973,
10 mandatory reporting in 1984. And currently
11 manufacturers must report deaths and serious
12 injuries if a medical device may have caused or
13 contributed to the event, and they're also required
14 to report malfunctions.

15 User facilities, and most notably
16 hospitals and nursing homes, have to report deaths
17 to the FDA and deaths and serious injuries to
18 manufacturers. Now beginning in the early '90s,
19 FDA received about 100,000 medical device adverse
20 event reports per year.

21 And currently, all told in our database,
22 we have slightly more than one million reports.

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1 Now these reports are submitted on standardized
2 forms and the information includes device
3 specifics, event descriptions, pertinent dates and
4 patient characteristics.

5 Unfortunately, many of these reports
6 often have very limited information. Even basic
7 information such as age and gender is missing from
8 a large portion of reports. Nonetheless, they can
9 provide us critical signals, signals for which
10 we'll take action.

11 What are some of those actions? The
12 MDRs may lead us to directed inspections of
13 manufacturers or facilities, product injunctions or
14 seizures, product recalls (as in the case of
15 surgical instruments being mislabeled), patient or
16 physician notifications (as in the case of steam
17 resterilization of zirconia ceramic femoral heads).

18 Also, it may lead to additional post market
19 studies.

20 Now we have two authorities to base our
21 requirements for a post market study. One is
22 Section 522 of FDAMA entitled "Post Market

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1 Surveillance," and one is under our PMA authority
2 for post approval studies, better known as
3 condition of approval studies.

4 Now under Section 522, that was
5 originally mandated in SMDA 1990, and it was
6 changed significantly in FDAMA '97. In the '90
7 version, there were actually categories and lists
8 of devices, the manufacturers of which were
9 required to do post market surveillance studies on,
10 regardless of whether there were pertinent public
11 health questions.

12 Those categories and lists no longer
13 exist in the FDAMA version, but we still have the
14 authority, the discretionary authority, to order
15 companies to perform post market studies if there
16 are pertinent public health questions.

17 Now, post approval studies or condition
18 of approval studies refer strictly to PMA products.

19 Our 510(k) authority extends our coverage to Class
20 II or III 510(k) products whose failure may present
21 a public health problem. Now, we see both
22 authorities as a complement to our premarket

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1 efforts.

2 Now, in implementing the FDAMA version
3 of post market surveillance, we publish criteria to
4 help guide our considerations on when to impose
5 post market surveillance on Class II or III
6 products. The principal criterion was that there
7 had to be a critical public health question.

8 Now, that could arise from "for-cause"
9 issues such as adverse events, concerns about newer
10 expanded conditions of use, concerns about effects
11 of the evolution of the technology. We also had to
12 consider whether there were other, more pertinent
13 post market strategies that could address -- better
14 address the public health question of interest such
15 as inspections or some aspect of the quality
16 systems reg.

17 Thirdly, we need to address whether the
18 studies are practical and feasible. Can we recruit
19 the number of patients that we'd like to? Can we
20 recruit physicians to do the studies? How will the
21 data be used?

22 This is particularly important for

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1 rapidly evolving technologies. By the time we get
2 the data, the data may be obsolete. And what's the
3 priority for this study? We live in an era of
4 limited resources. We have to assess what the
5 priority is, given the magnitude of the risk and
6 benefit.

7 Now once we decide to impose post market
8 surveillance, there are a variety of study
9 approaches -- study design approaches that may be
10 chosen. Obviously, the study design that is chosen
11 should match the public health question of
12 interest, and it should be the least burdensome
13 approach.

14 I've detailed a variety of approaches
15 starting from the most general to the most
16 sophisticated, most general being a detailed review
17 of complaint history literature, non-clinical
18 testing device, and so on and so forth.

19 And occasionally, we may lead to
20 randomized trials to address the public health
21 question of interest.

22 Now, we've experienced several

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1 frustrations in the post market period in
2 instituting these studies, especially early in the
3 life of 522, and we still experience some of these
4 difficulties today. Those being that the rapid
5 evolution of technologies may make studies
6 obsolete. By the time we get the data, the data
7 are obsolete.

8 There may be lack of incentives for
9 industry to do these studies. Industry may view
10 these studies as being bearers of bad news.
11 There's nothing positive for industry in terms of
12 doing these studies. And we have to change that
13 paradigm.

14 There may be lack of interest in the
15 clinical community in doing these studies,
16 especially on mature technologies. And early in
17 the program, there were instances of a lack of
18 clearly specified public health questions,
19 especially for mature technologies that were
20 required to be studied under the mandate, SMDA '90.

21 Now what is the challenge to the
22 advisory panel? And really, the challenges to us

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1 all. When considering post market studies, whether
2 they're post approval or 522, we need to ensure
3 that they're of primary importance; that they're
4 practical, feasible; that the resources are
5 warranted to do these studies.

6 Obviously, we need to clearly specify
7 the public health question. And we need to note
8 the clinical and regulatory relevance of answering
9 the question: What will we do with the data once
10 received? Are the data there to assure us that
11 what we see in the post market arena are similar to
12 what we know from premarket data? Are they there
13 to address residual questions? And so on and so
14 forth.

15 This last slide depicts the future of
16 MDR and post market surveillance. With regard to
17 medical device reporting, we're moving away from
18 individual reporting of well-characterized events
19 to summary reporting. We're moving away from
20 universal reporting by hospitals to focusing on a
21 representative set of hospitals and sentinel
22 reporting so that we can increase the quality of

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1 reporting.

2 We're moving towards electronic
3 interchange of reports, integration of our efforts
4 with the quality systems regulation, and exchange
5 of reports internationally.

6 On the post market surveillance side,
7 I've mentioned that we're applying a wider variety
8 of study design approaches. We'd like to work
9 collaboratively with industry and the clinical
10 community to achieve these studies. And we're also
11 attempting to get expanded access to relevant data
12 sources to address these issues such as registries.

13 That concludes my talk, and any
14 questions?

15 DR. YASZEMSKI: Seeing no questions,
16 thank you, Dr. Gross, for your presentation.

17 We'll now proceed with the open public
18 hearing session of this meeting. I'd like to ask
19 at this time that all persons addressing the panel
20 come forward and speak clearly into the microphone,
21 as our transcriptionist is dependent upon this
22 means for providing an accurate recording of this

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1 meeting.

2 We're requesting that all persons making
3 statements during the open public hearing session
4 of the meeting disclose whether they have financial
5 interests in any medical device company before
6 making your presentation to the panel, in addition
7 to stating your name and affiliation.

8 Please state the nature of your
9 financial interest, if any.

10 Is there anyone at this time wishing to
11 address the panel?

12 Since there are no requests to speak in
13 the open public hearing, we will now proceed
14 directly to the open committee discussion. I would
15 like to ask Mr. Jim Dillard, acting director of the
16 Division of General and Restorative Devices, to
17 provide an introduction to the concept of
18 reclassification.

19 MR. DILLARD: Thank you, Dr. Yaszemski.

20 I'd like to, with your permission, Dr.
21 Yaszemski, do something before I actually introduce
22 reclassification. As Mark touched on a little bit,

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1 we had a colleague that was very dear to our heart
2 and actually very dear to this panel, Dr. Tom
3 Callahan, who passed away a couple weeks ago.

4 And Dr. Callahan -- he started his
5 career at the FDA in 1978 and immediately joined in
6 the orthopedic area. His background was in
7 biomaterials. He came as a researcher from
8 institutions such as Stanford and Yale and had done
9 quite a bit of work in biomaterials and
10 biomaterials development.

11 And when we got him at the FDA, it was a
12 very good thing for us because he brought a lot of
13 expertise. He joined the orthopedics group in the
14 late '70s and moved to become the Branch Chief for
15 the Orthopedics Devices Branch, as well as the
16 Associate Director in the Division of Surgical and
17 Rehabilitation Devices, which, at the time, was the
18 name of the division that housed the orthopedic and
19 restorative group.

20 And Dr. Callahan was the associate
21 director over those two areas for quite a bit of
22 time through the 1980s, as well as very

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1 instrumental in the regulatory effort for silicone
2 gel-filled breast implants. Tom headed up the
3 review team.

4 And he, in the early '90s, moved on to
5 become the Director of the Division of
6 Cardiovascular Respiratory and Neurological Devices
7 where he spent the remainder of his career. And I
8 just wanted to make mention for the record that
9 we'll certainly miss Tom, and I know he was very
10 important to this panel and very important to the
11 FDA.

12 And I thought it was worthwhile just
13 noting some of the accomplishments in his career
14 before this panel, so --

15 DR. YASZEMSKI: Thank you, Mr. Dillard,
16 for those comments.

17 MR. DILLARD: Thank you.

18 In terms of reclassification, this
19 panel, I think, is well educated in
20 reclassification. We have spent a number of the
21 past couple to three panels actually asking for
22 your recommendation on reclassification petitions,

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1 and the reclassification petition today is no
2 different.

3 And what I wanted to do is just set a
4 little bit of the ground rules again for everybody
5 that what we're asking you to look at today is the
6 reclassification of a product that was a
7 preamendments Class III device that we called for
8 PMA under our Section 515(b) parts of our
9 regulations and called for PMAs -- and you will
10 hear a little bit more of this in the presentations
11 -- in the 1990s.

12 What this reclassification petition is
13 asking you all to do is to give a recommendation to
14 the FDA as to whether or not there will be adequate
15 controls that do not include premarket approval in
16 order to go to the market -- or product development
17 protocol -- in order to go to the market under the
18 authorities that either include general controls,
19 which are our Class I types of controls.

20 Are they adequate alone to ensure the
21 safety and effectiveness of these particular types
22 of products? Or could Class II controls, in

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1 addition to the Class I types of controls, help
2 control for the risks and adequately ensure the
3 safety and effectiveness of this product category
4 in general?

5 So what we'll be asking you to do -- and
6 as usual, we will have Marjie Shulman, who is our
7 reclassification coordinator for the Office of
8 Device Evaluation, she will help lead you through
9 the reclassification questionnaire after you have
10 deliberated over the issues.

11 Another bit of housekeeping is that
12 everybody does need to fill out a reclassification
13 questionnaire, although our Chair, Dr. Yaszemski,
14 will have the official sheet, which he will try to
15 develop consensus amongst you in order to give the
16 FDA a recommendation for reclassification.

17 But we do ask that all of you fill out a
18 questionnaire so that, if there are any additional
19 comments, we can consider them. And you may not
20 have them yet, but we will hand them out to you
21 right before we actually go through the formal
22 recommendation process from you as our panel.

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1 So with that, I think, Dr. Yaszemski, I
2 will turn it back over to you. I will be
3 available, as well as Ms. Shulman, during the
4 process for any help that you may need for the
5 process.

6 DR. YASZEMSKI: Thank you very much, Mr.
7 Dillard.

8 We'll now begin the discussion of the
9 reclassification petition for constrained hip
10 arthroplasty devices. We'll begin with the
11 petitioner's presentation followed by the FDA
12 presentation.

13 This then will be followed by two lead
14 panel member reviews. Dr. Besser will discuss the
15 preclinical aspects, and Dr. Skinner the clinical
16 aspects.

17 After Drs. Besser and Skinner, we'll
18 have a general panel discussion about this topic,
19 followed by a panel discussion aimed at answering
20 FDA's questions while going through the
21 reclassification worksheet that Mr. Dillard just
22 spoke to us about and the supplemental worksheet.

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1 We'll finish after the discussion by
2 voting upon our recommendation.

3 I'd like to remind public observers at
4 this meeting that, while this portion of the
5 meeting is open to public observation, public
6 attendees may not participate except at the
7 specific request of the panel.

8 We'll begin now with the petitioner
9 presentation from the Orthopedic Surgical
10 Manufacturers Association with Mr. Lonnie Witham.

11 Mr. Witham.

12 MR. WITHAM: Thank you.

13 Good morning. As he said, my name is
14 Lonnie Witham. And this petition was submitted by
15 the Orthopedic Surgical Manufacturers Association,
16 also referred to as OSMA.

17 I'm the immediate past president and
18 currently a member of the board of directors of
19 OSMA. OSMA is a trade association comprised of 23
20 manufacturers of orthopedic implants, surgical
21 instruments, and biological materials used in
22 orthopedics.

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1 And this is the sixth orthopedic device
2 reclassification petition OSMA has presented to the
3 panel over the past three years.

4 I'll give a brief overview of the
5 petition, but I won't cover those areas to be
6 addressed later by John Goode in the Agency's
7 presentation. I'll be followed by Dr. Thomas Brown
8 from the University of Iowa, who will discuss the
9 design considerations and recommended non-clinical
10 testing.

11 And then Dr. Andrew Brooker will discuss
12 the clinical aspects of the petition. The device
13 description I'm going to skip over because that
14 will be covered by John Goode later, as will the
15 indications for use.

16 He will cover more thoroughly the device
17 identification, which is the current CFR
18 classification of the metal/polymer constrained hip
19 prosthesis, which is currently Class III, and the
20 requested reclassification, which is Class II.

21 With that, I'll skip to the summary of
22 the reasons for reclassification. Number one, the

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1 materials, geometry, articulating interface and
2 fixation surfaces of the constrained hip prostheses
3 are typically very similar to Class II semi-
4 constrained prostheses.

5 Number two, the risks to health have
6 been identified and can be controlled by
7 preclinical testing, labeling, guidance documents,
8 published standards, and GMP and quality systems
9 requirements. These special and general controls
10 are the same as those used to control Class II
11 metal/polymer hip replacement prostheses.

12 Number three, although the published
13 experience with constrained hips is relatively
14 small in comparison to that of the total hip
15 arthroplasty in general, it's to be expected given
16 the relatively limited patient population and
17 indications for which the device is intended.

18 The published results have been
19 critically analyzed through a peer review process.

20 The results show consistency in pain relief,
21 restoration of function, and reduction in
22 recurrence of dislocation.

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1 The body of literature, along with the
2 experience with this device in the commercial
3 marketplace, demonstrates a safe and effective use
4 when regulated with Class II controls. And number
5 four, since these constrained acetabular liners are
6 not interchangeable from manufacturer to
7 manufacturer, it's important to the patient and,
8 thus, to the public health that a constrained hip
9 liner can be supplied by each manufacturer of a
10 total hip prosthesis.

11 If a compatible constraint liner is not
12 available to the surgeon, an entire well-fixed
13 acetabular prosthesis may have to be removed from
14 the patient in order to implant a constrained hip
15 prosthesis.

16 With that, we'll go the risks identified
17 by the previous panel. As you know, these devices
18 were discussed in two previous PMAs, and that gave
19 us a lot of groundwork for the risks to health and
20 the special controls needed to minimize those
21 risks.

22 Certain adverse events and complications

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1 were noted in the literature and in the previous
2 PMAs, and those were grouped into three major
3 categories. One is loss or reduction of joint
4 function. That includes loosening, revision of
5 components, implant failure, fracture and wear.

6 And to control those minimized risks, we
7 have ASTM material standards, ASTM test methods,
8 and we have three FDA guidance documents. Another
9 major category was adverse tissue reaction, which
10 included osteosynthesis, sensitivity to metal
11 implants.

12 Again, we have ASTM material standards
13 and FDA guidance documents.

14 The third category was infection. And
15 special controls to minimize that risk was 510(k)
16 sterility review guidance from the FDA. There were
17 additional risks identified: nerve impingement or
18 damage, pain, vascular disorders, pulmonary
19 embolism, gastrointestinal and genito-urinary
20 complications.

21 And these additional risks identified
22 are associated with orthopedic surgery in general

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1 and are not necessarily unique to a constrained hip
2 surgery.

3 To summarize the list of special
4 controls available, the following list of special
5 controls available to minimize the risks to health
6 identified by the petitioner and confirmed by a
7 previous panel. These special controls are in
8 addition to the general controls applicable to all
9 orthopedic implants.

10 These special controls include ten ASTM
11 standards for materials and test methods and six
12 FDA guidance documents. In addition, the FDA may
13 require certain mechanical testing as part of the
14 510(k) premarket notification. These tests will be
15 described later by Dr. Brown.

16 The ASTM standards define implant
17 material specifications and testing methods
18 applicable to the constrained hip prosthesis.
19 Adherence to these standards and comparison of the
20 results from these standard tests can control the
21 risk to health of adverse tissue reaction, pain
22 and/or loss of function, and revision by having the

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1 manufacturer use surgical implant quality materials
2 and assuring that the device has acceptable
3 performance through mechanical testing.

4 FDA guidance documents provide guidance
5 on how to meet general orthopedic device premarket
6 notification or 510(k) requirements, including
7 biocompatibility testing, sterility testing,
8 mechanical testing, and physician and patient
9 labeling.

10 Use of the preclinical section of the
11 FDA guidance documents can control the risk to
12 health of adverse tissue reaction, infection, pain
13 and/or loss of function, and revision by having
14 manufacturers use surgical quality implant
15 materials, adequately test and sterilize their
16 devices, and provide adequate directions for use
17 and patient information.

18 And another control is -- another
19 control is labeling. The following indications for
20 use, relative contraindications, warnings and
21 precautions were identified by a previous panel for
22 devices to be reclassified.

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1 We agree with the previous panel's
2 labeling recommendations, and no new information is
3 contained in this petition that would change the
4 labeling previously established. We also have the
5 -- we'll skip to the relative contraindications.

6 Three of those identified by a previous
7 panel, which I'm sure many of you -- some of you
8 participated in. Warnings -- these are
9 instructions to the surgeon on bending and
10 contouring or modifying the device, improper
11 alignment of the device, not to autoclave ultra-
12 high molecular weight polyethylene, things of that
13 nature which could cause an adverse reaction or
14 early device failure.

15 And the potential adverse effects, there
16 are 12 of those identified by the previous panel.
17 We found no new information to change those and
18 they'll stand as recorded by the previous panel.

19 In conclusion, we believe the risk to
20 health associated with the constrained hip can be
21 adequately controlled with Class II regulatory
22 requirements, and we hope the panel will agree and

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1 recommend these devices be reclassified.

2 And with that, I would like to introduce
3 Dr. Thomas Brown from the University of Iowa
4 Hospital Biomechanics Laboratory, and he'll present
5 the non-clinical testing.

6 DR. BROWN: Thanks very much.

7 Yes, my name is Tom Brown. I'm a
8 mechanical engineer, Professor of Orthopedic
9 Surgery in Biomedical Engineering at University of
10 Iowa, and I direct their biomechanics lab.

11 The OSMA folks asked me to come and
12 present some of the preclinical testing data for
13 these constrained devices. Apparently they asked
14 me to do this because our laboratory is active in
15 the research involving total hip dislocations.

16 I need -- I'm seeing these slides
17 actually for the first time. I need to point out
18 that data are largely lacking in terms of the
19 physiologic demands responsible for dislocations.
20 And most of you, I think, are aware of some of the
21 factors that are pertinent here -- certainly issues
22 of surgeon placement of the cups, issues of patient

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1 maneuvers and activities, and of course design
2 issues on the device itself.

3 Even though we don't have any hard
4 numbers as to what the physiologic demands are, at
5 least there are things that we can do in the
6 laboratory to objectively measure intrinsic
7 resistance to the dislocation and dissociation of
8 these devices.

9 And most of the -- back up a second,
10 please. Most of these laboratory tests are
11 designed to evaluate what would be the failure
12 modalities here, which I think are basically two
13 that are specific to this issue.

14 One is redislocation of the device. And
15 secondly, dissociation between the liner and the
16 backing. Responsible for the dissociation and
17 dislocation are really pull-out sort of things and
18 lever-out sort of things.

19 So the testing that's designed for this
20 designated as a lever-out resistance, a push-out
21 resistance of the liner relative to the backing.
22 And then number (c) and (d) here, push-in and pull-

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1 out of the head and then the moment necessary to
2 lever-out or toggle-out the femoral head.

3 Okay, this lever-out resistance between
4 the liner and the shell -- here basically the head
5 and the acetabular shell are tested and basically a
6 lever-out moment is applied in an MTS or Ingstrom-
7 type testing.

8 Slide, please.

9 This test (b) basically is an axial push
10 of the liner out of the shell backing. This would
11 be a test essentially of the locking mechanism.

12 Slide, please.

13 And then these (c) tests here are
14 pertinent to the dislocation issue or relocation
15 issue, an axial push-in and, more importantly, a
16 pull-out of the shell relative to the head. And
17 this pull-out would obviously be a concern for
18 these constrained devices, whereas it would not for
19 a garden variety, semi-constrained device.

20 Slide, please.

21 And then lastly, a sort of a dislocation
22 resistance. This is a test performed to determine

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1 the torque that's needed to toggle the femoral head
2 out of the socket during an impingement event.

3 Slide, please.

4 Okay, there's a relatively limited
5 amount of testing that's been done here, most of it
6 by in-house work in the manufacturers and a little
7 bit from the Mt. Sinai lab, Seth Greenwald's.
8 Biomet's data for their device -- they have a hard
9 number for the lever-out force necessary to
10 disassociate.

11 They have a hard number for the push-out
12 resistance of the liner from the shell, as well as
13 to push the head into the shell. These obviously
14 are going to be design specific. As a point of
15 reference -- let's see. No, I think I want the
16 next slide.

17 There are three liners for which there
18 is fair amount of data available. Again, these are
19 from the different manufacturers. Pull-out data
20 for the heads out of the shells; and then, I think
21 most importantly, for dislocation, these toggle-out
22 data.

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1 And as a point of reference, at least in
2 our laboratory we've worked a lot with semi-
3 constrained device lever-outs and typical numbers
4 to dislocate are on the order of 70 inch-pounds.
5 So these things are all substantially more
6 resistant to that than the semi-constrained device.

7 And I think that's the end of my slides,
8 so I guess I'm here to answer any biomechanical
9 questions that might come up.

10 Thank you.

11 MR. WITHAM: I'd like to introduce Dr.
12 Andrew Brooker. He's an orthopedic surgeon
13 specializing in total joints. He was Professor of
14 Orthopedics at Johns Hopkins for 19 years, and he's
15 now in private practice and has been for the last
16 four years in Amarillo, Texas.

17 He's a member of the Hip Society and
18 AOA.

19 Dr. Brooker.

20 DR. BROOKER: Thank you.

21 Not having presented to this group
22 before, I did my notes on an envelope while

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1 traveling here. I thought first, with apologies to
2 the orthopedic surgeons in your group, it might be
3 beneficial to just briefly explain what we're
4 talking about.

5 The two types that Tom referred to of
6 constrained liners are fundamentally either a ball-
7 in-ball design where the liner fits into an
8 existing metal shell and there are two balls within
9 that. The trunnion of the femoral head goes in and
10 motion takes place at two intervals.

11 The second is a ring-lock device where
12 the polyethylene device locks into the metal cup.
13 The femoral head goes into that and a ring-lock
14 extends over the tabs, thereby holding the head in.

15 The major differences that you see in the lever-
16 out force occur because in the ring-lock device the
17 poly extends all the way around the femoral head
18 and is held with a ring-lock.

19 The interesting thing about these is
20 that they are manufacturer specific. So, when you
21 are confronted with an individual who has an
22 existing total hip in and becomes what we call a

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1 "recurrent dislocator," you either have to go with
2 that manufacturer's specific version of a
3 constrained liner or, in the instance of a very
4 large number of my patients, having used a system
5 that does not provide a constrained liner, I have
6 to remove the existing bone ingrowth liner in order
7 to go to a constrained device.

8 The indications -- indications are
9 largely either to treat recurrent dislocation or to
10 prevent anticipated dislocation or recurrent
11 dislocation. The population at risk -- and let's
12 have this one slide -- we were able to come up with
13 a number of studies that give an average risk of
14 dislocation following the semi-constrained or
15 standard total hip replacement.

16 This falls in a range of one to six,
17 with an average of 3.3%. This is not the
18 population that we're talking about using
19 constrained liners on. The population to use
20 constrained liners is that group that -- the 3.3%
21 that then go on to suffer recurrent dislocation.

22 I, myself, over the years, have told my

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1 patients that dislocate after a primary hip
2 replacement that their chances of redislocating are
3 about 20%, somewhere in the 15 to 20% range.

4 I am not familiar with a study that puts
5 a hard value on that because there are so many
6 variables involved in the reason for a patient
7 dislocating -- not only position of the implant,
8 but age, weight, muscle strength and all that.

9 So what we're talking about in the
10 population is basically perhaps in the range of 15%
11 of the 3.3 group that dislocate. The important
12 consideration for this concept is that it provides
13 a very successful way of treating a very difficult
14 problem.

15 Most of these are elderly individuals,
16 frequently overweight. The typical patient that
17 becomes a recurrent dislocator is a little, old
18 lady living by herself on the cusp of going into a
19 nursing home who goes home from rehab, falls within
20 the first month post op, dislocates, tears out all
21 of the supporting soft tissue structures in the
22 back of the hip, comes in, is relocated and then

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1 goes on to recurrent dislocation.

2 The options for treating her are
3 conservative management, which is bracing,
4 abduction supports and this sort of thing, which
5 are, in my experience, wholly unsuccessful in the
6 elderly and overweight.

7 Imagine wearing an abduction brace made
8 of polypropylene from around your waist to at least
9 your knee if you're 80 years of age and 180 pounds.

10 It just isn't something that works very well or is
11 commensurate with their activity.

12 Reoperating to a semi-constrained or a
13 standard total hip has certainly been attempted.
14 And if you study these individuals and become
15 convinced the reason they're dislocating is because
16 your cup version or your femoral version is way
17 off, then going in and revising those is a
18 significant operation, particularly if they're
19 cemented stems, and often fraught with, I feel,
20 increased problems postoperatively because of the
21 loss of supporting structures, muscle injury, etc.

22 Very commonly you will study these

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1 individuals and not see an obvious malalignment of
2 either the cup or the stem and be forced to
3 reoperate on them trying to use what we call "dial
4 a prayer," which is a high wall or elevated liner
5 that you put in a certain position hopefully to
6 prevent dislocation.

7 One of the largest problems that has
8 been created in my practice is individuals who
9 recurrently dislocate who then surgeons reoperate
10 on and put a longer and longer neck on, both
11 lengthening and lateralizing the hip as they do.

12 I have a number of patients that have
13 presented with recurrent dislocations who are
14 already over an inch to an inch and a half long on
15 the affected side because of attempts to stabilize
16 them. This is much akin to the weight placed in
17 the ear at age 12, and by age 20 your ear's down at
18 your waist.

19 You continue to lengthen, these soft
20 tissues continue to expand, and there's no end to
21 that problem. The beauty of the constrained device
22 in treating recurrent dislocation is it's the only

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1 device I know that can allow you to shorten this
2 leg, bringing it back to a normal length, yet
3 gaining stability.

4 In that sense, I would point out that I
5 think there are some other indications for the
6 constrained device that relate to the risk of
7 dislocation or recurrent dislocation, and that
8 includes particularly patients who have either had
9 large tumor reconstructive or trauma surgery which
10 leaves them without abductors.

11 If you have, say, a proximal femoral
12 replacement where you have no abductor balance, you
13 don't properly decelerate the hip when you walk
14 and, after a period of time, the hip becomes very
15 lax and you get into recurrent dislocation.

16 In those individuals, constrained liners
17 provide a good way of treating a difficult problem.

18 Further, I feel there are a number of people at
19 risk for dislocation -- the Alzheimer's-type
20 patients and the elderly, modestly demented folks
21 who are still functional.

22 I have one individual who is an

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1 Alzheimer's patient, lives at home with his wife,
2 had hip replacements and dislocated on one side,
3 had a constrained liner allowed him to continue his
4 activity even though he was functionally unable to
5 really follow hip precautions.

6 Slides.

7 They've prepared some slides here just
8 to show you a little bit how small the numbers
9 really are. Again, the J&J S-Rom is the double
10 ball system. Excuse me, the J&J S-Rom and the
11 Biomet Ringloc are the two -- the ring-lock
12 concept. The Osteonics Omnifit is the double ball.

13
14 Again, the range simply reflects the
15 range of people having hip replacements. Although,
16 if you live in Texas, the mean range of 156 to 177
17 pounds is like saying Larry Allen weighs 200
18 pounds.

19 Go ahead.

20 Follow up -- again, this is a difficult
21 number to really hang much on because most of these
22 people come to you recurrently dislocated, and to

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1 establish what their scores were pre and post
2 becomes a little murky because do you go all the
3 way back to their pre total hip, or do you just
4 consider how they were total hip? Many of them
5 really haven't recovered long enough to even really
6 establish a pre score.

7 Number of the cases that were revision
8 cases, most all of these have been revision cases.

9 I would point out that the number being somewhat
10 lower in the ring-lock.

11 Over half of these are my cases. And
12 because the numbers become small and you start
13 dealing with people who are either demented or
14 Alzheimer's or who have had tumor surgery, that
15 changes the statistics very rapidly.

16 So fundamentally, they're pretty much
17 all multiple dislocation of revisions.

18 Recurrent dislocations in this group.
19 This is a series where the numbers are very low
20 considering the population. What you're doing is
21 you're taking individuals that have already been
22 recurrent dislocators, operating on them and

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1 putting a constrained device in them.

2 Go ahead.

3 In summary, all of the obvious things.
4 The redislocation rate is extremely low. The other
5 complications have been commensurate with revision
6 surgery. There's nothing particularly unique about
7 this operation.

8 In fact, this is an operation that, if
9 you have a device that actually locks into the
10 existing cup and you're satisfied with the existing
11 cup and femoral version, it's an extremely
12 straightforward operation and relatively short for
13 the patient.

14 In summary, I would simply say that I
15 think that it would be good to have these available
16 for all manufacturers' cups because there is a
17 large population of otherwise healthy people who
18 have ingrown acetabular cups who will require
19 treatment of recurrent dislocation and it would be
20 very advantageous to them to be able to do it
21 without having to remove a solidly ingrown, porous-
22 coated or bone ingrowth cup.

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1 Thank you.

2 DR. YASZEMSKI: Thank you very much.

3 I'd like to ask Mr. Goode from the FDA
4 to present the FDA's thoughts at this time.

5 MR. GOODE: Good morning.

6 My name is John Goode and I'm with the
7 Orthopedic Devices Branch and the lead reviewer for
8 the metal/polymer constraint total hip prostheses
9 reclassification petition.

10 I'd like to thank the petitioner for
11 their presentation.

12 Before I get started, I'd like to pass
13 around what we've been referring to, which I have
14 the Biomet and the Johnson & Johnson components,
15 which are, as the petitioner described, the ring-
16 lock variety where a ring locks the acetabular
17 liner onto the femoral head.

18 And then, I also have only one of these.

19 This is the Osteonics Omnifit device that is the
20 bipolar type component. I just have the acetabular
21 part of this. This would have a metal stem which
22 came off this side and a metal shell which would

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1 lock it into the acetabulum.

2 So I'll pass these around and you can
3 take a better look at them. So I have the Johnson
4 & Johnson version on this side and I have the
5 Biomet and the Osteonics versions on this side.

6 I'll provide an overview of the
7 premarket application history for metal/polymer
8 constrained hips. Then I will present the current
9 reclassification for these devices and compare that
10 with the petitioner's proposal.

11 I'll identify the proposed indications
12 for use and device description outlined in the
13 petition. I'll briefly summarize the supporting
14 information.

15 I'll give an update of the FDA's medical
16 device reporting system and compare that with the
17 risk to health identified in the original
18 classification and in the petition, and list the
19 types of special controls proposed by the
20 petitioner to limit those risks.

21 Finally, I'll present several specific
22 questions the FDA has for the panel.

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1 Metal/polymer constrained total hip
2 prostheses are preamendments, that is, devices
3 available before the medical device amendments in
4 1976. In July of 1982, after reviewing the
5 recommendations of the orthopedic devices section
6 of the surgical and rehabilitation devices panel,
7 the FDA issued a proposed rule proposing to
8 classify these devices as Class III.

9 The final rule in which FDA classified
10 these devices in Class III was published in
11 September of 1987. From September of 1987 to
12 December of 1996, manufacturers were able to market
13 these devices via 510(k) premarket notifications
14 that the FDA determined to be substantially
15 equivalent to legally marketed devices.

16 During this period of time, FDA cleared
17 five 510(k)s for these devices. On September 7th
18 of 1995, FDA published a proposed rule requiring
19 the filing of a premarket approval, a PMA, or a
20 notice of completion of a product development
21 protocol, or a PDP, for these devices.

22 The comment period for the proposed rule

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1 closed on January 5th of 1996. And according to
2 the FDA Dockets Management Branch, they received no
3 new comments regarding constrained hip prostheses.

4 In September of 1996, FDA published the final rule
5 for these devices requiring a PDP -- a completed
6 PDP or a PMA by December 26, 1996.

7 Two orthopedic companies, Johnson &
8 Johnson and Osteonics, Inc., filed PMAs for their
9 constrained hip prostheses and both PMAs were
10 approved in June of 1997. The current
11 classification states that a hip joint
12 metal/polymer constrained cemented or uncemented
13 prosthesis is a device intended to be implanted to
14 replace a hip joint.

15 This device prevents dislocation in more
16 than one anatomic plane and has components that are
17 linked together. This generic type of device
18 includes prostheses that have a femoral component
19 made of alloys such as cobalt-chromium-molybdenum,
20 and a acetabular component made of ultra-high-
21 molecular-weight polyethylene.

22 This generic type of device is intended

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1 for use with or without bone cement. This device
2 is not intended for biological fixation. That is
3 the current classification and the sponsors -- or
4 the petitioner's proposed classification is very
5 similar to the current version.

6 The petitioner's proposal provides a
7 definition regarding which implants are to be
8 included or excluded from this classification. In
9 the petitioner's proposed classification, ultra-
10 high-molecular-weight polyethylene acetabular
11 component may be used with or without a metal
12 shell.

13 That's one of the changes that's bolded
14 on the screen. In addition, they eliminated the
15 statement that this device is not intended for
16 biological fixation. That was also included in the
17 original classification definition.

18 The petitioner has proposed a change in
19 the classification of these devices from Class III
20 to Class II. Total hip prostheses or orthopedic
21 reconstructive devices intended to replace the
22 principal articulating surfaces of the hip joint,

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1 that is the femoral head and the acetabulum.

2 Hip replacement is typically performed
3 when the surfaces of the femoral head and
4 acetabulum have been severely damaged by
5 degenerative joint disease or traumatic injury.
6 The main objectives of this procedure are to
7 relieve pain and restore function.

8 Constrained hip devices are a subset of
9 total hip replacement devices. And while they are
10 used to relieve pain and restore function, they are
11 made for a patient that is at high risk to
12 dislocate the femoral head from the acetabulum.

13 Therefore, the specific indications for
14 use proposed by the petitioner for the
15 metal/polymer constrained hip devices are for
16 patients at high risk of dislocation due to a
17 history of prior dislocation, bone loss, soft
18 tissue laxity, neuromuscular disease, or intra-
19 operative instability.

20 The proposed device description for
21 constrained total hip prostheses include a metallic
22 stemmed femoral component that is fixed in the

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1 femoral intermedullary canal with or without bone
2 cement, an acetabular component that consists of a
3 polyethylene constrained liner that may be used
4 with or without a metal shell component, and
5 fixation of the acetabular component in the
6 acetabulum is achieved with or without bone cement.

7 The femoral and acetabular components
8 are linked together, typically by a locking ring
9 that secures the polyethylene constrained liner
10 around the femoral head (for example, the Biomet
11 and the Johnson & Johnson device) or a bipolar
12 component like the Osteonics device.

13 This linkage stabilizes the hip joint
14 and provides resistance to dislocation. The
15 constraining polyethylene liner retains the head of
16 the femoral component. This reduces the travel
17 distance of the femoral neck, and therefore the
18 range of motion of the hip joint is reduced as
19 compared to a semi-constrained total hip.

20 As the petitioner presented, there were
21 nine clinical articles containing information on
22 overall outcome and complications provided in the

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1 petition.

2 Of the nine articles, five included
3 information on the Johnson & Johnson S-Rom device,
4 two included information on the Osteonics Omnifit
5 device, and two included information on other
6 preamendment constrained devices, the SRN and the
7 Russin-Sivash devices.

8 The petitioner also provided unpublished
9 information regarding the Biomet Ringloc
10 constrained hip prostheses. The petitioner
11 provided a bibliography on the available
12 literature, as well as copies of the articles in
13 the petition that each panel member has received.

14 The sponsor has stated that a literature
15 search was performed using orthoguide.com that
16 include a Medline search designed for orthopedics.

17 The keywords searched were "constrained" and
18 "hip." The search was for all articles from 1967
19 to the present.

20 All articles that contain information on
21 constrained hips were included in the petition, and
22 there were a total of nine articles identified.

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1 The second search that the sponsor performed used
2 the key words "hip" and "dislocation."

3 These references were to establish an
4 overall dislocation rate following semi-constraint
5 total hip arthroplasty. Nine references were
6 chosen because they reviewed a large number of
7 cases and they were already presented by the
8 petitioner.

9 Now I will summarize the information
10 gathered from FDA's medical device reporting
11 system. The MDR system can give us an indication
12 of the types and relative incidence of various
13 adverse events, but there are limitations to what
14 the medical device reports can tell us.

15 Some events go unreported either because
16 the manufacturer doesn't find out about them, or it
17 is determined that the event is unrelated to the
18 device. The reporting period summarized in the
19 petition was from January 1985 through December
20 1998.

21 There were a total of 91 medical device
22 reports for constrained hip devices. Fifty-six of

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1 the 91 reports concerned dislocations. Twelve
2 dislocations occurred during normal activities.
3 Ten occurred due to a dislocation of the femoral
4 head from the polyethylene liner, and it was
5 suspected that this was due to impingement of the
6 femoral neck on the acetabular rim.

7 Nine dislocations were due to
8 misalignment of the components, and 25 were of
9 unknown cause. Eleven reports involved the
10 disengagement of the polyethylene liner from the
11 metal shell. Seven reports were concerning a
12 broken locking ring that holds the polyethylene
13 liner onto the metal head.

14 Five reports were concerning revision.
15 And there were other reports in the one to two
16 category that were either ring migration, broken
17 insert, cement loosening, tapers unlocked, liner
18 wear, device split, poor liner fit, the ring
19 wouldn't fit, and the size was mislabeled.

20 In 1982, the following risks to health
21 were identified in the Federal Register notice
22 proposing constrained hip prostheses for Class III,

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1 and these were considered by the original panel.

2 The petitioner has already presented
3 these, the loss or reduction of joint function,
4 adverse tissue reaction and infection. In addition
5 to those risks, the petitioner provided the
6 following list of risks to health from the
7 literature and those reported under MDR.

8 And these include loosening or revision
9 of components; dislocation; implant failure,
10 fracture and wear; osteolysis; sensitivity to metal
11 implants; infection; nerve impingement or damage;
12 pain; vascular disorders; pulmonary embolism;
13 gastrointestinal and genitourinary complications.

14 The risks identified by the petitioner
15 are more specifically delineated, but still appear
16 to fall in the broader categories first identified
17 by the original classification panel. However,
18 there may be additional risks of which you are
19 aware, and the questions I will read later will
20 include a request for you to identify any
21 additional risks to health for constrained
22 prostheses.

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1 In order to control the risks to health,
2 the petitioner has identified various types of
3 special controls to ensure the safety and
4 effectiveness of constrained hip prostheses as
5 Class II devices.

6 These include conformance to consensus
7 standards such as the ASTM and isomaterial
8 standards presented by the petitioner, FDA guidance
9 documents, the preclinical component testing as
10 discussed by Dr. Brooker, I believe -- or Dr. Tom
11 Brown, and labeling to ensure the devices' proper
12 use in appropriate patients.

13 As you are considering the risk posed by
14 these devices, you may identify other special
15 controls you find to be appropriate. You will be
16 able to add to these -- add these to the list when
17 you fill out the general device classification
18 questionnaire.

19 General controls such as good
20 manufacturing practices and design controls may
21 also be sufficient to limit some of these risks.

22 Now that I've provided some information

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1 on constrained hip prostheses, I would like to
2 address five questions to the panel -- I'm sorry,
3 four questions to the panel.

4 Each of the members of the panel should
5 have a copy of these questions in your packet of
6 information. Your answers to these questions will
7 be recorded on the reclassification questionnaire
8 after your preliminary deliberation.

9 The first question is: Does the
10 petitioner's proposed classification sufficiently
11 describe metal/polymer constrained hip devices? If
12 not, what other types of descriptive information
13 should be included in the classification
14 definition?

15 And this will be question S-1 in your
16 questionnaire.

17 Number two: Based on the known clinical
18 information, for which patient population(s) should
19 constrained hip devices be indicated for use? This
20 is question S-4 on your questionnaire.

21 Number three: Risks to health have been
22 identified by the petitioner, the previous panel,

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1 and the medical device reports. Have all of the
2 risks to health for constrained hip prostheses been
3 identified? And if not, what additional risks
4 should be described?

5 And the final question: The original
6 classification included devices to be fixed with or
7 without bone cement, but specifically excluded
8 devices intended for biological fixation. What
9 impact does the means of fixation have on
10 constrained devices (for example, cementing,
11 hydroxyapatite coating, porous coating, or press-
12 fit)?

13 Has the petitioner provided sufficient
14 information to reclassify devices intended for
15 cemented, uncemented and/or biological fixation?

16 I'd like to thank you for your
17 attention. I'll now turn the floor back over to
18 the panel chair for discussion.

19 DR. YASZEMSKI: Thank you, Mr. Goode.

20 This is Dr. Yaszemski speaking. I'm
21 going to ask at this point, since everybody on the
22 schedule has been identified by their presentation,

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1 and since we are now going to transition into a
2 general discussion in which it won't be apparent to
3 the transcriptionist who is speaking, I will ask
4 all the panel members and others who approach the
5 microphone to identify themselves before they speak
6 and ask your tolerance with me in advance if I -- I
7 will try to introduce you if you neglect to do it
8 for yourself.

9 Let's all please try to identify
10 ourselves for the transcriptionist, and I'll try to
11 pick up on it if you don't.

12 We're going to begin now with two
13 reviews by our panel lead reviewers, first by Dr.
14 Besser regarding the preclinical status, and then
15 followed by Dr. Skinner with respect to clinical
16 considerations.

17 Dr. Besser.

18 DR. BESSER: Yes, this is Mark Besser.
19 This is Mark Besser. The preclinical testing
20 that's been described by both the petitioner and
21 referred to by the FDA presenter, I'm not going to
22 reread it again. Essentially the five -- the

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1 testing falls into both materials testing and I
2 think that the ASTM standards for the materials
3 involved, the materials have been tested.

4 And I think the preclinical testing for
5 the materials doesn't need additional addressing by
6 this panel. For the actual devices, looking at
7 both the shell liner disassociation, the push-out
8 and lever-out tests that have been described, and
9 there are standards for those.

10 And for the femoral head dislocation,
11 both the toggle-out force or torque and the push-in
12 and pull-out forces have also been described by the
13 standards. I don't think that -- I had no further
14 comments or requirements for additional preclinical
15 testing to be done for these devices.

16 I do think that for each design and each
17 new design presented it's essential that
18 preclinical testing be done for that design. And
19 you can't say that this is similar to previous
20 designs and assume that you're going to end up with
21 the same resistance to either liner disassociation
22 or femoral head dislocation just because the design

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1 looks similar.

2 So with the standards for preclinical
3 testing that are currently in place, I think that
4 no additional requirements for preclinical testing
5 are necessary at this time.

6 DR. YASZEMSKI: Thank you, Dr. Besser.

7 We'll now ask Dr. Skinner to present --
8 Dr. Yaszemski here will ask Dr. Skinner to present
9 his clinical discussion.

10 DR. SKINNER: For the record, my name is
11 Harry Skinner again.

12 The nice thing about talking last is
13 that you don't have to say anything. I can just
14 sit down now and say it's all been said.

15 Next slide.

16 Just a little review. The incidence of
17 dislocation, according to Morrey, is about 3%, and
18 it doesn't seem like there's a significant learning
19 curve. And it's a devastating problem for people
20 who have a dislocation.

21 It's a devastating problem for the
22 surgeon, too. There are many, many risk factors

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1 that have been identified to go along with
2 dislocation, and those risk factors come down to --
3 the largely important ones are surgical approach,
4 component position, component design -- and by that
5 I mean things like sleeves, skirts, extended
6 liners.

7 And then the patient has a significant
8 effect on this. I think Dr. Brooker alluded to
9 this. Patient's ability to comply is probably one
10 of the major problems I see in dislocations that I
11 take care of.

12 And the diagnosis is significant too.
13 Ehlers-Danlos, Parkinson's Disease, things like
14 that are significant problems that lead to the need
15 for things like constrained cups.

16 Next, Mark.

17 The constrained liner is an alternative
18 when the component position is acceptable, when you
19 can't use something like an extended liner, an
20 extra thick liner, increased neck length, etc.
21 Many things that you can use to take care of
22 dislocations.

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1 Next.

2 Well, regarding the adequacy of
3 information to support reclassification, we've
4 heard about this to a great extent. And with the
5 huge total hip literature that's out there, which
6 are already Class II devices, I think that the
7 issues about polyethylene surfaces, metal surfaces,
8 attachment of the liner to the inside of the -- to
9 the plastic, all of these things have been pretty
10 well taken care of with the total hip literature.

11 And I think that what we have to deal
12 with here is the issues relating to constraint,
13 which is a small part of that whole topic. And as
14 has already been stated, there's a very small
15 constrained liner of literature.

16 Next.

17 So the issues are the preclinical data,
18 the appropriate patient population and special
19 controls. On the right you see a slide that shows
20 one of the S-Rom components in place, and that ring
21 is what you see on x-ray with one of these things.

22 Next slide.

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1 With the preclinical data, I think the
2 important things are the range of motion of the
3 device and the arc of motion of device, which are
4 really different things because these things, as
5 you noticed when they were passed around, have
6 offsets to them, so that the -- while the arc of
7 motion may be 70 degrees -- the range of motion of
8 the device may be 70 degrees, the arc of motion
9 might be from 20 degrees of flexion to 90 degrees
10 of flexion, or the reverse.

11 So where the arc is, is quite important
12 in these things. And that's something that I think
13 we have to address in the final product literature
14 that's on this stuff. The pull-out and lever-out
15 things are important for the liner and the cup, the
16 liner and the head, and the last thing that was
17 addressed just recently was the cup and the bone.

18 Next slide.

19 The literature's already shown us the
20 data for these. Tom Brown mentioned these numbers.

21 And I think what these numbers show us -- and I
22 think Dr. Besser alluded to these, too -- is that

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1 these two devices anyway, the Osteonics and the S-
2 Rom, are pretty successful devices on the market at
3 the present time, and I think they give us a
4 general range for what is required for any new
5 devices that come onto the market. And I think
6 that is what the goalpost should be that the new
7 products that would presumably come along in a
8 Class II situation would have to jump over.

9 Next slide.

10 The cup/bone is something that is a very
11 serious problem with these things. Generally the
12 manufacturers -- I think that's Osteonics and Joint
13 Medical Products, Johnson & Jonson -- have tried to
14 make it so that there's been a problem -- if
15 there's a problem either at the femoral head
16 plastic or the plastic shell rather than at the
17 cup/bone interface because that's better for the
18 patient than having the cup come completely out of
19 the pelvis with a large piece of bone or even
20 perhaps even break the pelvis.

21 So the issue of adequate fixation of the
22 cup on the bone is a significant issue with these

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1 particular devices much more than with any other
2 device.

3 Next slide.

4 The head/neck geometry is significant.
5 Many of the heads that are available today have
6 cutouts at the base where it goes into the Morse
7 taper. And that's going to change the lever-out or
8 toggle-out effect of the head, and I think that has
9 to be taken into account when these things are
10 tested.

11 Next slide.

12 Indications for use, as suggested by the
13 manufacturer, I think are very good, but I think
14 there should be an additional caveat because, at
15 the very minimum, the rep who is in the room with
16 the surgeon who will know this information, because
17 the surgeon certainly won't know it, will be able
18 to say, "Doctor, is there any other way that you
19 can stabilize the hip from dislocation?"

20 Because that's what the package insert
21 indication says, and that's why I've suggested the
22 statement at the bottom. And you can see the slide

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1 on the right what happens with one of those Johnson
2 & Johnson cups when they dislocate. That wasn't
3 one of my cases, by the way.

4 Next slide.

5 Special controls -- I think they've been
6 gone over quite adequately. The ASTM standards,
7 the special guidance documents for the FDA, but I
8 think also there has to be an education and
9 training process for the surgeon.

10 Because, for instance, for the J&J
11 product, if you put the ring on backwards, it will
12 almost certainly fail. And it's a subtle
13 difference when you put that metal locking ring on,
14 and I'm sure the same thing happens with the Biomet
15 process.

16 So I think those are things that have to
17 be addressed, too.

18 Thank you very much.

19 DR. YASZEMSKI: Dr. Yaszemski here.

20 Thank you, Dr. Skinner.

21 We're now going to proceed to the
22 general panel discussion. I'd like to take a

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1 moment and outline what that will consist of.

2 First we're going to go around the table
3 and ask each panel member whether they have any
4 general comments related to the presentations
5 they've heard from either the petitioner, the FDA
6 or our preclinical and clinical lead reviewers.

7 During that time, I would ask the panel
8 members to begin to consider the general data sheet
9 and the supplemental data sheet, because our task
10 will be to come to a consensus on how these sheets
11 are filled out and to make a recommendation to the
12 FDA as to what the filled out sheets should
13 contain.

14 So please, if you would, while we're
15 going around the table the first time, start giving
16 consideration to what you feel should be included
17 in those sheets. And I would ask each panel member
18 to fill their names in at the top of the sheets
19 because the FDA will be collecting these sheets
20 from us at the conclusion of our deliberations.

21 After we've done that, we'll ask the FDA
22 to put up the specific questions posed to us, and

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1 we'll go around the table again to ask the panel
2 what we feel should be our answers to those
3 specific questions, and those answers will be put
4 down in the form of the filled out sections of both
5 the general and supplemental data sheets.

6 I'd like to start now, if I could, by
7 asking Dr. Cheng to begin the general discussion.
8 And then we'll go around the table in clockwise
9 fashion and we'll go then to Dr. Hannaford and Dr.
10 Aboulafia and the other panel members in order.

11 Dr. Cheng, do you have any general
12 comments on what we've heard this morning?

13 DR. CHENG: I have some general
14 comments, but first I'd like to have your
15 permission to ask a question of OSMA.

16 DR. YASZEMSKI: So granted.

17 DR. CHENG: I'm wondering, is there any
18 data which you've presented, perhaps I've missed,
19 that addresses cemented polyethylene cups, either
20 metal or metal backed? I believe these are all
21 ingrowth, is that correct?

22 Does anyone care to address that

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1 question?

2 Let me give you my general comments and
3 he can answer that in a moment. I think it's a
4 valuable tool in the surgeon's armamentarium to
5 have these, but I think it's rarely ever required -
6 - hopefully rarely ever required.

7 And hopefully we don't have to use them
8 very often because there is a high incidence of
9 potential problems, as the MDRs indicated, and
10 you're dealing with a very difficult population of
11 patients.

12 I would advise the FDA to consider
13 changing the indications and adding a statement
14 much as Harry said. I wrote a different one that
15 just said that these only be considered after all
16 other possible issues, such as component
17 malposition, placement, leg lengths and
18 trochanteric function have been addressed.

19 I would list a contraindication, which
20 is specifically the malposition of a component.
21 I'd be concerned that surgeons would use this as a
22 simple means to address the dislocation when

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1 perhaps there are other issues that should be
2 addressed first.

3 I think the preclinical testing is very
4 important to be done because every -- the testing
5 is device-specific and there are a number of cups
6 where we know that the liner disassociation has a
7 lower threshold for occurring than for other
8 specific manufactured devices, and so the
9 preclinical testing would be important.

10 And I think the rationale that OSMA
11 presented for reclassification is reasonable.

12 DR. YASZEMSKI: Thank you, Dr. Cheng.

13 Do we have a comment from the
14 petitioners regarding Dr. Cheng's question.

15 Mr. Witham, thank you.

16 MR. WITHAM: We did have some
17 information in the petition concerning the number
18 of cemented and uncemented procedures from the
19 published articles, but it was very difficult
20 sometimes to determine what the fixation method
21 was.

22 For acetabular cups, we were able to,

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1 from the published articles, identify 207
2 uncemented and 15 cemented. The femoral stems,
3 there were 127 cemented and 18 uncemented, which is
4 just about reversed, and 79 undetermined.

5 The Biomet study, there were 60
6 uncemented, 22 cemented acetabular cups. And since
7 it was done retrospectively, for the most part, we
8 had 72 that were undetermined. So there's a
9 mixture, but the ones we were able to identify are
10 -- there are more uncemented than cemented on the
11 acetabular site.

12 DR. YASZEMSKI: Thank you, Dr. Witham.

13 Dr. Cheng.

14 DR. CHENG: The reason I asked that
15 question is, the very first question the FDA asked
16 us is if the proposed classification sufficiently
17 describes it, and I'm not sure the cemented cups
18 are appropriate for use for this. Or at least
19 there's minimal data that's been presented in that
20 regard.

21 DR. YASZEMSKI: Thank you, Dr. Cheng.

22 Dr. Hannaford.

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1 DR. HANNAFORD: I think the issues here
2 are primarily medical ones. It appears to be a
3 very mature technology. But I would say that, from
4 an engineering perspective, I would agree with the
5 previous two panelists that this preclinical
6 mechanical testing would certainly seem warranted.

7 It would seem very necessary not to -- I
8 guess what I mean is it would seem clear that each
9 different design is going to have different
10 mechanical properties and should -- which should be
11 documented and carefully tested.

12 DR. YASZEMSKI: Thank you, Dr.
13 Hannaford.

14 Dr. Aboulafia.

15 DR. ABOULAFIA: Albert Aboulafia. I
16 have no general comments at this time, although I
17 think we will discuss the modification of other
18 methods likely to fail and things as time goes on,
19 and I'll reserve that for later.

20 DR. YASZEMSKI: Thank you, Dr.
21 Aboulafia.

22 Dr. Walker.

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1 DR. WALKER: Dr. Skinner's comments I
2 think were excellent. This is a small population.
3 It's in the patient's best interest to, in all
4 cases, keep a functional acetabular cup rather than
5 having to revise it.

6 I noticed that the original Class III
7 guidelines forbade biological fixation and now
8 biological fixation is being included, but I
9 haven't heard any words today about testing or
10 proof that the increased loading when there's --
11 when you run out to the end of range of motion
12 would still allow biological fixation to take
13 place.

14 And I guess my question is more for the
15 orthopedic surgeons. Does it ever happen that you
16 run out of range of motion with a constrained
17 device? Clearly, with an unconstrained device, it's
18 unlikely. And is that going to affect the fixation
19 of the femoral component if you do?

20 Maybe one of the orthopedic surgeons
21 could talk about that.

22 DR. YASZEMSKI: Would anybody like --

1 Yaszemski. Would anybody like specifically to
2 answer Dr. Walker's question at this time, or shall
3 we include that in the specific discussion when we
4 get to that panel question?

5 Dr. Brooker.

6 DR. BROOKER: I'm sure if we go far
7 enough around the panel, Dr. Skinner's going to
8 comment on this because this is the direction he
9 was heading with his slides. But the only time
10 that we have seen clinically where there has been a
11 problem with range of motion was in the initial use
12 of these with skirted implants. In other words,
13 the elongated femoral heads that effectively
14 thickened the neck and therefore caused impingement
15 to occur at a very much earlier time.

16 And I think that is -- particularly in
17 the ring lock devices, I think that's clearly a
18 contraindication for using those devices, and I
19 think that should be a consideration.

20 I can't resist the temptation to address
21 one issue. I think that when you consider further
22 verbiage about evaluating other methods, one of the

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1 things to consider, or way to put it, is you might
2 want to state that the constrained device may be
3 indicated if the femoral head and cup are in a
4 satisfactory position.

5 Because if the femoral head and cup
6 aren't in a satisfactory position, then you're
7 already behind the eight ball in terms of your
8 range of motion. On the other hand, there are
9 those people in whom it is in position where you
10 might not consider soft tissue or trochanteric
11 osteotomy.

12 So I think one of the centerpieces here
13 -- and again, I'm stealing Dr. Skinner's thunder
14 because I think he's probably heading in that
15 direction -- is if the patient has good aversion
16 and alignment of both the acetabular device and the
17 femoral device in place and it's still dislocating.

18 DR. YASZEMSKI: Thank you, Dr. Brooker.

19 Dr. Walker, does that answer your
20 question?

21 DR. WALKER: Yes, maybe we can get to
22 the biological fixation later.

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1 DR. YASZEMSKI: Thank you.

2 Dr. Silkaitis.

3 Dr. Brooker, can we come back to that
4 when we come around the room again? I think we're
5 going to expand on that as we go around, but thank
6 you.

7 Dr. Silkaitis.

8 DR. SILKAITIS: Yes, this is Ray
9 Silkaitis. And I guess my question is maybe
10 directed more towards the FDA. We're looking at
11 this particular design, cemented, uncemented,
12 various characteristics of the constrained hip, and
13 we're making recommendations regarding its
14 indications and risks associated with it.

15 I guess my question is that there are
16 already two devices approved by PMA; how does that
17 fit into the evaluations that are being performed
18 here?

19 DR. YASZEMSKI: Mr. Dillard.

20 MR. DILLARD: Yes, Jim Dillard.

21 I believe, Dr. Silkaitis, in terms of a
22 regulatory situation and perhaps a scientific

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1 situation -- and maybe let me break those out a
2 little bit, although they're very much together.

3 The regulatory situation is if these
4 products, in a general class of products, are
5 reclassified to Class II, and the two existing PMA
6 products would be converted to a Class II type of
7 device, and that in the future, if any
8 modifications were to be made to those devices, the
9 submission of a 510(k) premarket notification would
10 be necessary instead of a supplement to the
11 premarket approval application.

12 One of the other things that goes along
13 with a reclassification is that the potential post
14 market and quality system regulation components
15 that go with a Class III device do change when you
16 go from a Class III to a Class II or a Class I.

17 Most of the post market requirements are
18 increased in the Class III category, and they are
19 somewhat diminished in the Class II. Not from the
20 standpoint of not still being considered -- you
21 still must meet the quality system regulation and
22 you still must meet design control activities as a

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1 Class II device, as you would as a Class III
2 device.

3 Reporting requirements are somewhat
4 diminished under the PMA requirements. You have to
5 submit annual reports on your device. That
6 requirement is not there for Class II premarket
7 notification products.

8 From the standpoint of the science, the
9 threshold for decision making, as everybody
10 probably well knows, is a little bit different.
11 There is not an absolute requirement for
12 determination of reasonable assurance of safety and
13 effectiveness under a 510(k) premarket
14 notification. The standard is to demonstrate that
15 you are substantially equivalent to a device that's
16 on the market.

17 So, in terms of the type of prospective
18 data that may be required under a PMA to
19 demonstrate reasonable assurance of safety and
20 effectiveness, the target would more be on are you
21 equivalent to, and the two devices that are
22 approved are really the two devices that perhaps

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1 will define that category, are you equivalent to
2 two devices that are legally on the market, and
3 those two devices are currently legally on the
4 market.

5 So they will sort of set the benchmark.

6 DR. YASZEMSKI: That's Dr. Silkaitis
7 talking again, excuse me.

8 DR. SILKAITIS: I'm sorry, thank you.

9 That's with the guidance documents that
10 are available in terms of the requirements for
11 preclinical testing that all that is met under the
12 510(k), is that right?

13 MR. DILLARD: Jim Dillard.

14 The guidance documents don't necessarily
15 set down requirements. They are intended as
16 guidance documents. Although, if they are
17 recognized as special controls, they will be
18 formalized as something that the manufacturer needs
19 to consider in a 510(k) premarket notification.

20 So substantial equivalents -- or the
21 idea of a 510(k) and substantial equivalents really
22 sets down more the benchmark, I would say. And

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1 those products that are on the market and those
2 testing performance criteria that those products
3 currently meet become more the standard, I think,
4 in terms of substantial equivalence.

5 DR. SILKAITIS: So we're looking at
6 decisions today affecting the entire class, even
7 those that have been previously approved?

8 MR. DILLARD: Yes.

9 DR. SILKAITIS: Thank you.

10 DR. YASZEMSKI: Thanks, Dr. Silkaitis.
11 Anything further?

12 DR. SILKAITIS: No.

13 DR. YASZEMSKI: Mr. Dillard, have you
14 any further comments?

15 MR. DILLARD: No, thank you.

16 DR. YASZEMSKI: Thank you.

17 Dr. Skinner.

18 DR. SKINNER: Just a couple comments.

19 Dr. Skinner.

20 First of all, I think the consensus of
21 the orthopedic surgeons who have used these devices
22 or who have at least experienced patients with

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1 dislocations is that these shouldn't be used
2 routinely, and I think that's something that we
3 would like to get across in the Class II
4 description.

5 When it comes to the preclinical data,
6 what I've mentioned in the past discussion, I think
7 that the preclinical data that's important from a
8 biomechanical viewpoint is the toggle-out and
9 lever-out type of failures of the devices.

10 And I think that, for instance, the
11 push-out of the cup is -- well, to use a push-out
12 test pushing out through the hole in the back of
13 the cup I think is kind of like pulling our leg.

14 (Laughter.)

15 It's not as valuable as you might think.

16 I think that toggle-out tests should also include
17 heads with skirts and heads with chamfers on them
18 because both of these may affect the toggle-out
19 significantly.

20 I think an important thing to document
21 in the information that goes to the surgeon is the
22 range of motion in these situations, too. As Dr.

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1 Brooker alluded to, you put a skirt on one of these
2 things and the range of motion, which might
3 otherwise be 70 degrees, might drop down to 50
4 degrees, and that puts the patient at a very high
5 risk of dislocation.

6 Anybody that's done hip revision surgery
7 knows that there are times when you'd be happy to
8 be able to leave the operating room feeling
9 comfortable that there's 50 degrees motion and it's
10 not dislocating, but you would rather not have that
11 happen and you'd rather try to keep -- you'd rather
12 try to avoid that. Knowing about that gives you a
13 little bit more information to deal with while
14 you're working on this problem.

15 Again, I'd like to come back to the
16 cup/bone interface. I think that it should be
17 discouraged to use these inserts in cups that don't
18 have a means of resisting tension between the cup
19 and the bone.

20 I think porous coating, particularly if
21 it's ingrown, is certainly one way of accomplishing
22 that. I think cement would do that. I think that

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1 screws would do that. I'm not sure that a
2 relatively smooth surface with hydroxyapatite on it
3 would do that.

4 So those are my comments.

5 DR. YASZEMSKI: Thank you, Dr. Skinner.

6 Dr. Larntz.

7 DR. LARNTZ: Kinley Larntz.

8 And I'm a statistician, so I have to
9 look at things from that point of view, or I choose
10 to anyway. I did read somewhere it says here, it
11 says since -- this is from the manufacturer, or
12 from the manufacturer association -- "Since the FDA
13 classifies these devices into Class III, the
14 development of devices and surgical technique has
15 continued and a considerable body of published
16 clinical results have appeared in the peer review
17 literature."

18 This body of "new information" provides
19 the grounds for the present petition. If that's
20 what the present -- if that's the grounds, then
21 that's not here because I don't consider this a
22 considerable body of literature by any stretch, and

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1 I think you said that.

2 There's almost been nothing done. Very,
3 very small number of cases providing the three --
4 for three devices, two of which are already
5 approved. What's interesting to me though is also,
6 as a statistician -- and we all get reputations as
7 statisticians for nitpicking.

8 Well, I'll do it. And in fact, in fact,
9 there's double counting even in the materials
10 presented. One of the studies is actually a subset
11 of the other study, and then they add up the cases.

12 That doesn't fly with me, and I think it's very
13 clear if you read the articles, which we could not
14 do for one of the devices, that, in fact, you'll
15 see that double counting's there. For whatever
16 reason, there was some summaries going on today
17 that said 90% of the cases were revisions.

18 Again, if you go back and read the
19 articles, eliminate the double counting, 25% of the
20 cases are primary, 75% are revisions. Now 25% is
21 not 10%. That's all I'm going to say. And besides
22 that, last point, if you look at the two approved

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1 devices, dislocation rates are very different --
2 very, very different.

3 Now, what does that say? Well, that
4 says to me, as a statistician, well that says these
5 devices are very different. And so they have to be
6 considered individually and carefully, and I'm not
7 here to say how that individual and careful
8 decision making should be done, but it's very clear
9 that the two approved devices have very different
10 abilities to function with respect to dislocation.

11 Also, I said that was the last point. I
12 apologize. None of the data for the two devices is
13 any later than 1993. So new information -- I don't
14 know how new information counts in this day of
15 electronic and wonderful things accumulating very
16 fast.

17 Much of the data that was published --
18 and even the data that was published in 1998, the
19 series goes from 1988 to 1993. That's the case
20 where one series is a subset of the other. So,
21 enough said.

22 DR. YASZEMSKI: Thank you, Dr. Larntz.

1 Dr. Laurencin.

2 DR. LAURENCIN: Laurencin.

3 My comments really just echo Dr.
4 Skinner's and also Dr. Larntz in terms of the area.
5 Just want to underscore the fact, in terms of
6 general comments, that the area is very, very
7 important because, as we see, revision rates start
8 to creep up over the years while the rates of --
9 the rates in which this is used now is low.

10 As revision rates creep up and as we see
11 more bone loss, surgeons will be more and more
12 tempted to use these sorts of devices, and as more
13 manufacturers make these devices and bring them
14 into the operating room, I think that surgeons will
15 be more tempted to use these sorts of devices.

16 So I think it's going to be very
17 important that really stringent criteria be given
18 in terms of their use. That should be written into
19 -- you know, if there's a reclassification, written
20 into that.

21 Also, on the issue of biological
22 fixation, it really does appear that initial

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1 fixation is even more important in these devices
2 than in the semi-constrained types of devices, and
3 so I think that it's going to be important that the
4 committee consider really establishing criteria in
5 terms of biological devices.

6 For instance, I was looking at a couple
7 of the reviews and Cameron's review -- his
8 recommendation is that any biologically fixed
9 device has to be augmented with screws because of
10 the early failures that he's seen with biological
11 fixation devices and the feeling that, with the
12 extra loads that are placed there, that screws
13 should be used.

14 So I think that should also be
15 considered.

16 DR. YASZEMSKI: Thank you, Dr.
17 Laurencin.

18 We're next going to go around again with
19 the specific intention of coming to a consensus on
20 both the general device classification
21 questionnaire and the supplemental data sheet.

22 I'd like to make one housekeeping

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1 announcement, if I can, prior to starting. And
2 that is, it appears that we perhaps will have a
3 chance to move lunch up a little bit, so I'm going
4 to ask in advance that we consider having lunch
5 from 12:00 to 1:00 and starting the afternoon
6 session at 1:00, and we'll adjust that as we go
7 along, but we'll at least try to do that if we
8 continue on a fairly rapid pace.

9 Secondly, with respect to the two data
10 sheets, what I would ask as we go around -- we're
11 going to give each panel member an opportunity to
12 express their particular views as to what should be
13 included in the data sheets.

14 The general -- I would ask you, for the
15 general data sheet, to allow me to present what
16 I've filled out and then go around and ask anybody
17 if they have anything different because it's the
18 more straightforward of the two, and perhaps we can
19 reach a consensus on the first general sheet that
20 way.

21 Then, for the supplemental data sheet,
22 we'll ask the FDA to put up the questions, and we

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1 will answer -- that is, fill out and come to a
2 consensus on the items on the supplemental data
3 sheet based upon our discussion of the specific
4 questions.

5 Dr. Skinner, did you have a comment?

6 Oh, I'm sorry, Dr. Besser, I thought
7 that from your lead review that you had had a
8 chance to go around, and I apologize for neglecting
9 you. Dr. Besser, please accept my apology and
10 offer your comments in the general around the
11 table.

12 DR. BESSER: Your apology is accepted.
13 It's Dr. Besser.

14 Just one comment, I guess, about one of
15 the things that Dr. Skinner had brought up about
16 the fixation of the acetabular shell and the
17 bone/cup interface. Essentially, as these devices
18 are being designed, you actually do want them to
19 fail either at the liner/cup interface or the
20 femoral head liner interface before they fail at
21 the bone/cup interface.

22 So that possibly the published values

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1 for the two devices that are currently on the
2 market might be considered more of a target than a
3 goalpost, to steal Dr. Skinner's metaphor.

4 If you make them too hard to either
5 dislocate or disassociate, you're going to have the
6 problems that Dr. Skinner described and risk
7 disassociation at the bone/cup interface instead,
8 which is, as I understand, much harder to correct.

9 DR. YASZEMSKI: Thank you, Dr. Besser.

10 I'd like to proceed -- before we go into
11 the second round of the table discussion with the
12 questions, ask once more if we can have an open
13 public session, and ask the persons in the audience
14 if anybody would like to make any comments at this
15 time prior to us going into deliberation on the
16 worksheets.

17 Anyone from the audience wish to address
18 the panel at this time?

19 Seeing none, let's proceed to the
20 worksheets. I'm going to go over the general
21 device classification questionnaire first. I would
22 ask that I be allowed to run through the answers

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1 that I've put down on it and then ask if there is
2 consensus on those answers or disagreement.

3 The petitioners, the OSMA, the
4 Orthopedic Surgical Manufacturers Association. The
5 generic type of devices are constrained total hip
6 arthroplasty devices.

7 Question number one, life sustaining or
8 life supporting? No.

9 Number two, is the device for use which
10 is of substantial importance in preventing
11 impairment of human health? Yes.

12 Number three, does the device present a
13 potential unreasonable risk of illness or injury?
14 No.

15 And number four is yes. Did you answer
16 yes to any of the above three?

17 Number seven, is there sufficient
18 information to establish special controls to
19 provide reasonable assurance of safety and
20 effectiveness? Yes. If yes, check those controls
21 needed.

22 These would be performance standards,

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1 testing guidelines, and in the "other" category,
2 those special controls mentioned by the presenters
3 this morning that can be agreed upon on the
4 supplemental data sheet, and the device labeling
5 controls, again which will be discussed and agreed
6 upon for the supplemental data sheet.

7 Number eight, if a regulatory
8 performance standard is needed to provide
9 reasonable assurance of the safety and
10 effectiveness of a Class II or III device, identify
11 the priority for establishing such a standard.
12 High priority. No other devices available to deal
13 with this particular patient population.

14 Number ten is not applicable.

15 Number 11(a), can there otherwise be
16 reasonable assurance of its safety and
17 effectiveness without restrictions on its sale,
18 distribution or use because of any potentiality for
19 harmful effect or the collateral measures necessary
20 for the device's use? No.

21 11(b), identify the needed restrictions.

22 In the "other" category, I would suggest that it

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1 be limited to use by a surgeon and that the
2 labeling specifications, as will be discussed and
3 agreed upon in a supplemental data sheet, be
4 included.

5 I would motion that this be our general
6 device classification sheet and would ask the panel
7 now if anybody has comments relative to it. If
8 there are some, let me hear now.

9 Mr. Dillard.

10 MR. DILLARD: Yes, Jim Dillard.

11 I wanted to just make one clarification
12 because it's one that is usually needed for this
13 particular type of exercise.

14 Performance standards for number seven,
15 just a point of clarification. Performance
16 standards here in this context means an FDA
17 developed, mandated through notice and comment rule
18 making performance standard for these particular
19 types of devices.

20 Those types of performance standards
21 have generally, in the past, not been very
22 successfully developed. It's not that we can't do

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1 it; it's just that based on notice and comment rule
2 making, they tend to be quite difficult and quite
3 time consuming getting there.

4 So in order to check that box, you need
5 to consider that what you're asking FDA to do is
6 develop a mandatory performance standard that will
7 go through that type of process. Sometimes it's a
8 terminology issue here.

9 If you are thinking consensus standards
10 or those standards that have been developed by
11 organizations such as ASTM and ISO, those we would
12 consider to be consensus standards and to be under
13 the "other" category here.

14 So, just a point of clarification and
15 one thing that you ought to consider for
16 performance standards.

17 DR. YASZEMSKI: Yaszemski.

18 Mr. Dillard, I was considering consensus
19 standards, and it was my intention that these be
20 voluntary standards by the manufacturer in line
21 with -- manufacturers, that is -- in line with the
22 data that they've presented to us and not anything

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1 regulated by the FDA.

2 I would change my recommendation, based
3 upon Mr. Dillard's suggestions, and uncheck that
4 box labeled performance standards.

5 Other comments from the panel?

6 Hearing none, I would suggest that we
7 now go around the table.

8 Dr. Besser.

9 DR. BESSER: Dr. Besser.

10 Do we have to answer question nine?

11 DR. YASZEMSKI: Thank you, Dr. Besser.

12 I neglected question nine and I checked no for
13 question nine.

14 Yaszemski.

15 MS. SHULMAN: Actually -- Marjorie
16 Shulman, FDA.

17 With taking away the performance
18 standards out of number seven, we don't have to
19 answer eight or nine because --

20 DR. YASZEMSKI: Thank you.

21 MS. SHULMAN: -- questions eight and
22 nine just --

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1 DR. YASZEMSKI: Thank you. So noted.

2 Any other comment -- Yaszemski -- any
3 other comments relative to the general
4 questionnaire?

5 Hearing none, let us accept this as a
6 draft which we will vote on at a later time in the
7 morning, and let us proceed to the panel questions
8 and the supplemental data sheet.

9 Question one. Question one pertains to
10 block one, generic type of device on the
11 supplemental data sheet. In addition, question
12 four is going to pertain to block one. And I would
13 ask then that we perhaps consider question one
14 first and then question four out of order, if we
15 might, and address block one on the supplemental
16 data sheet by our answers to those.

17 Question one: Does the petitioner's
18 proposed classification sufficiently describe
19 constrained hip devices? If not, what other types
20 of descriptive information should be included in
21 the classification definition?

22 And let's go around the table again.

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1 Dr. Besser, would you mind if we start
2 with you and go around in the clockwise order?

3 DR. BESSER: Dr. Besser.

4 I think that the suggested
5 classification, which I don't have in front of me,
6 was -- sufficiently describes the constrained hip
7 devices. I would like to hear the opinions of some
8 of the orthopedic surgeons as we go around as to
9 whether to include devices that are biologically
10 fixed.

11 DR. CHENG: This is Dr. Cheng.

12 I originally thought the answer to this
13 question was yes. And then, as I thought more, I
14 changed my answer to now because I think there is
15 insufficient evidence to consider use of this in
16 the cemented cup.

17 I'm not talking about the femoral stem.

18 I don't think that's an issue here as much. And
19 there's -- in answer to Dr. Walker's earlier
20 question, I don't think we can glean much
21 information from that, but it probably doesn't make
22 a lot of difference.

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1 DR. YASZEMSKI: Thank you, Dr. Cheng.

2 Before we move to Dr. Hannaford, I've
3 asked our FDA colleagues to put up the proposed
4 classification so we can all be looking at it as
5 we're discussing it.

6 Dr. Hannaford.

7 DR. HANNAFORD: I don't think this falls
8 within my expertise, so I'll decline to answer.

9 DR. YASZEMSKI: Thank you, Dr.
10 Hannaford.

11 Dr. Aboulafia.

12 DR. ABOULAFIA: I do believe that the
13 proposed definition that has been set forth is
14 adequate and don't recommend any changes.

15 DR. YASZEMSKI: Thank you, Dr.
16 Aboulafia.

17 Dr. Walker.

18 DR. WALKER: Everything appears adequate
19 to me except for that last sentence, and I still
20 haven't heard any demonstration that with the
21 unusual mechanical loading that this device has
22 characteristics that it has that anyone has shown

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1 that biological fixation of the acetabular cup or
2 the femoral component is going to be adequate to
3 prevent failure at that point.

4 So, if there's no data, then I don't
5 know -- obviously the biological fixation was not
6 allowed in the original classification and I
7 haven't heard the reason why it should now be
8 allowed in this classification.

9 And I think this is something that has
10 to be done proactively. We can't just eliminate it
11 without good reason.

12 DR. YASZEMSKI: Thank you, Dr. Walker.

13 Dr. Yaszemski here. For the record, I'm
14 going to read that last statement that Dr. Walker
15 referred to.

16 It states, "This generic type of device
17 is intended for use with or without bone cement."

18 Thank you.

19 Dr. Silkaitis.

20 DR. SILKAITIS: Yes, I guess my comment
21 is in regards to maybe consistency with the
22 previous panel, which I believe maybe the majority

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1 of us were here when it was originally reviewed. I
2 believe that the acetabular components at that
3 time, the indication for the product was use with
4 or without bone cement.

5 So if information hasn't changed since
6 then, I would say that the classification as
7 proposed should stand.

8 DR. YASZEMSKI: Thank you, Dr.
9 Silkaitis.

10 Mr. Dillard, have you comments?

11 MR. DILLARD: No comments at this time,
12 thank you.

13 DR. YASZEMSKI: Thank you, Mr. Dillard.

14 Dr. Skinner.

15 DR. SKINNER: Dr. Skinner.

16 I think the biological fixation issue is
17 one that's left over from history. I think that
18 this sentence was put in virtually everything that
19 was put on the market for a number of years, that
20 it's not intended for biological fixation.

21 I think that's the reason it was there
22 then and isn't there now. Maybe Mr. Dillard will

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1 correct me on that. I think the proposed
2 classification is adequate as stated by the
3 manufacturer.

4 DR. YASZEMSKI: Thank you, Dr. Skinner
5 Dr. Larntz.

6 DR. LARNTZ: No additional comments. It
7 looks fine.

8 DR. YASZEMSKI: Thank you, Dr. Larntz.
9 Dr. Laurencin.

10 DR. LAURENCIN: Laurencin.

11 You know, I think that -- I agree on one
12 hand with Dr. Skinner that that sentence is
13 probably there because it was -- in the time it was
14 being discussed, that sentence was always there in
15 all the different implants.

16 However, for this particular implant, it
17 actually has some special meaning because of the
18 thought that initial fixation is -- can be an issue
19 in terms of dislocation, or actually
20 disarticulation of the implant from the bone.

21 So I'm not sure whether it actually
22 should be removed or that we should somehow address

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1 it in terms of at least addressing or saying we
2 think it's fine to be in or it should be fine with
3 initial supplementation with screws or some
4 statement to that effect.

5 DR. YASZEMSKI: Thank you, Dr.
6 Laurencin.

7 Are there any other comments from the
8 panel on question one?

9 MR. DILLARD: Dr. Yaszemski? Jim
10 Dillard.

11 DR. YASZEMSKI: Mr. Dillard.

12 MR. DILLARD: If you would like me to
13 address Dr. Skinner's comment or question. I
14 believe that both Dr. Skinner and Dr. Laurencin are
15 on the right track here. In terms of this
16 particular statement, when the classification
17 panels met in the last '70s and early '80s, there
18 was no information for biological fixation.

19 And I think at the time it was added to
20 pretty much every implant, whether it was on, in
21 the case of a hip, the acetabular side or the
22 femoral side. It was pretty much in all the

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1 comments.

2 One of the things this panel has been
3 addressing, I think for all these reclassification
4 petitions, has been the issue about fixation. And
5 I believe there have been recommendations from this
6 panel on both sides. Under some circumstances,
7 there's enough information for both biological
8 fixation to be removed, because additional
9 information has come out in the literature in order
10 to support that; and there have also been comments
11 made that there is no information that would
12 support the removal of biological fixation under
13 some of the circumstances.

14 So this particular panel has given us
15 recommendations on both sides and it's been
16 predominantly based on the amount of data that's
17 been available for the particular type of devices.

18 There has been also some discussion,
19 I'll just mention, by this panel about whether or
20 not generically the idea of removal of biological
21 fixation could be handled across various joints.
22 And we have never really had this as an item before

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1 this panel.

2 In general, it's giving me some good
3 ideas for the future perhaps to do that. I think
4 in this case I would agree with Dr. Laurencin to
5 say that we would like to have your comments on
6 this particular joint and whether or not -- and
7 this particular implant design, and whether or not
8 that sentence could be removed under this
9 circumstance.

10 So with that, unless there's any other
11 questions --

12 DR. YASZEMSKI: Thank you, Mr. Dillard.
13 Yaszemski.

14 I would like to ask FDA to put question
15 four up at this time because the discussion for
16 question one moved over into the topic of question
17 four and I think we've begun that discussion. And
18 before I make a summary to the FDA of what we feel
19 on this issue, I'd like to ask us to discuss
20 question four.

21 Question four is up. It reads, "The
22 original classification included devices to be

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1 fixed with or without bone cement, but excluded
2 devices intended for biological fixation. What
3 impact does the means of fixation have on
4 constrained designs (for example, cemented, HA-
5 coated, porous-coated or press-fit)?

6 "Has the petitioner provided sufficient
7 information to reclassify devices intended for
8 cemented, uncemented and/or biologic fixation?"

9 And I'd like to give everybody on the
10 panel an opportunity to comment again on this
11 because it is posed as a separate question. And if
12 you feel that your comments to question one have
13 adequately covered your feelings for question four,
14 please so state and we'll move on.

15 Dr. Besser.

16 DR. BESSER: Dr. Besser.

17 I think that points that have been
18 brought up with reference to question one are --
19 have already been adequately stated. I have
20 nothing to add.

21 DR. YASZEMSKI: Thank you.

22 Dr. Cheng.

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1 DR. CHENG: I do not think the
2 petitioner has provided sufficient information for
3 cemented usage. For uncemented usage, I think it's
4 insufficient information for a scientist; but
5 reasonably speaking, this is a -- it is a valuable
6 tool sometimes and I think it should be released
7 for use.

8 So, from that standpoint, I think it is
9 sufficient.

10 DR. YASZEMSKI: Thank you, Dr. Cheng.

11 Dr. Hannaford.

12 DR. HANNAFORD: No additional comments.

13 DR. YASZEMSKI: Thank you, Dr.
14 Hannaford.

15 Dr. Aboulafia.

16 DR. ABOULAFIA: I do have one comment.
17 You know, we're talking about biological fixation
18 and I think in some of our own minds we know that
19 we're talking about primary versus revision when we
20 bring up this issue.

21 I think if acetabular component is well
22 fixed, you're revising it, it's biologically fixed,

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1 I don't know if any one of us would suggest not to
2 use the constrained liner. So I think we have to
3 at least make that distinction if indeed you want
4 to make the distinction about biological ingrowth
5 or not.

6 DR. YASZEMSKI: Thank you, Dr.
7 Aboulafia.

8 Dr. Walker.

9 DR. WALKER: There are two questions up
10 there. The first question up there I don't have
11 the expertise to answer. The impact question, as a
12 scientist, I don't feel I've been provided
13 sufficient information to include biological
14 fixation.

15 DR. YASZEMSKI: Thank you, Dr. Walker.

16 Dr. Silkaitis.

17 DR. SILKAITIS: I have not additional
18 comment at this time.

19 DR. SILKAITIS: Thank you, Dr.
20 Silkaitis.

21 Mr. Dillard.

22 MR. DILLARD: Nothing further at this

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1 time.

2 DR. YASZEMSKI: Thank you, Mr. Dillard.

3 Dr. Skinner.

4 DR. SKINNER: Well, I think Dr.
5 Laurencin and I are on the same wavelength on this.

6 I think that in order to put in one of these
7 constrained cups, the interface between the bone
8 and the cup should tolerate tensile stress, should
9 be able to accept tensile stress.

10 And some of those up there would, and
11 some of them would not tolerate tensile stress.

12 And I would want to discourage the surgeon from
13 using one of these constrained cups in a situation
14 that would not tolerate tensile stress because the
15 lever-out mechanism would be likely to pull it out.

16 It would be less damaging than pulling
17 out a porous-coated prosthesis, porous-coated
18 acetabulum, but it would still be to the detriment
19 of the patient, I think.

20 DR. YASZEMSKI: Thank you, Dr. Skinner.

21 Dr. Larntz.

22 DR. LARNTZ: I have nothing to add with

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1 this particular point, except I do not believe the
2 petitioner has provided sufficient information,
3 period.

4 DR. YASZEMSKI: Thank you, Dr. Larntz.
5 Dr. Laurencin.

6 DR. LAURENCIN: Again, I echo what
7 everyone else has said, but the point is that the -
8 - that, number one, I guess we don't have a lot of
9 information in terms of what's in the literature,
10 which I guess was the basis of their petition
11 saying that we do have new information.

12 But we don't have a lot of new
13 information about the biological fixation side.
14 When I looked at the literature, the only paper
15 that actually addressed biological fixation and
16 sort of gave recommendations was Cameron's paper
17 where he actually recommended that for the very
18 initial fixation that all of the ingrowth types of
19 prostheses on the acetabular side should be
20 reinforced with screws, in his experience.

21 So my feeling is just with that piece of
22 information I have from the literature is that

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1 there should be some reinforcement in the very
2 beginning for initial biological fixation if we're
3 going to be using this implant because we know the
4 stresses are going to be higher than with
5 conventional implants, at least initially.

6 DR. YASZEMSKI: Thank you, Dr.
7 Laurencin.

8 Dr. Yaszemski here.

9 I'd like at this time, if I can, to
10 provide a summary of the just-completed panel
11 discussion regarding panel questions one and four
12 for the FDA and ask the FDA if we've adequately
13 answered questions one and four.

14 It's the view of the panel that the
15 device classification as proposed by the
16 petitioners is such that, from a scientific
17 perspective, not enough information has been
18 presented to cover the indications of cemented use
19 and biologic fixation, especially with respect to
20 the resistance to tensile forces at the cup/bone
21 interface.

22 The panel feels that the use of the "not

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1 intended for biologic fixation" statement that has
2 previously been included in these types of devices
3 is, in fact, historical, but that scientific
4 information to dispute the non-biologic fixation
5 issue has not been presented.

6 On the other hand, if surgeons recognize
7 that these devices should be used infrequently and
8 in relatively limited indications, then these
9 devices constitute a very useful tool in the
10 armamentarium of the surgeon, especially for
11 revision cases, and that perhaps consideration
12 should be given to assuring that there is some
13 resistance to tensile forces thought of and
14 supplied at the time of surgery, in which case
15 these devices will be quite useful to the patients
16 in those limited indications that we've discussed.

17 FDA, have we adequately answered your
18 concerns regarding questions one and four?

19 MR. DILLARD: Yes, you have. I realize
20 that you also have to put some of this down on the
21 supplemental data sheet; but I think from the
22 standpoint of the question, that's adequate.

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1 Thank you.

2 DR. YASZEMSKI: Thank you, Mr. Dillard.

3 Dr. Yaszemski here.

4 I'd like to ask now that we proceed to
5 question number two. I'll read question number
6 two.

7 "Based on the known clinical
8 information, for which patient populations should
9 constrained hip devices be indicated for use?"

10 Dr. Besser, can we start with you again?

11 DR. BESSER: Dr. Besser.

12 No comment at this time.

13 DR. YASZEMSKI: Thank you, Dr. Besser.

14 Dr. Cheng.

15 DR. CHENG: Well, I would say patients
16 who have recurrent dislocations which are not
17 solvable or amenable to any other solution. I
18 mean, this is only to be used when the surgeon's
19 back is up against the wall, and we discussed one
20 of those positions or the components.

21 DR. YASZEMSKI: Thank you, Dr. Cheng.

22 Dr. Hannaford.

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1 DR. HANNAFORD: No comments.

2 DR. YASZEMSKI: Thank you.

3 Dr. Aboulafia.

4 DR. ABOULAFIA: I think it's a
5 reasonable question. In some ways, it becomes a
6 difficult one to put down on paper to answer, only
7 because Dr. Skinner suggests that something like
8 "other methods likely to fail" certainly works
9 better than some of the other ones that have been
10 proposed.

11 But I think ultimately it becomes a
12 clinical decision. You might opt for a 45-minute
13 operation and someone who does have alternative
14 methods of solving the problem, but those
15 alternative methods may be a four hour operation
16 that you didn't think is in the patient's overall
17 best interest.

18 You know, in the example of the
19 dislocated constrained prosthesis that Dr. Skinner
20 showed, he showed an acetabular component that
21 looked clearly malpositioned. But I think there
22 are cases when you're looking for a quicker

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1 solution; specifically those very low-demand, high-
2 risk, high operative morbidity patients.

3 So I think when you actually try and put
4 it down into words, you have to leave some leeway
5 for clinical decision making.

6 DR. YASZEMSKI: Thank you, Dr.
7 Aboulafia.

8 Before we ask Dr. Walker for his input,
9 let me read for the record the proposed indications
10 for uses. This is Dr. Yaszemski.

11 "Patients at high risk of hip
12 dislocation due to a history of prior dislocation,
13 bone loss, soft tissue laxity, neuromuscular
14 disease or intraoperative instability."

15 Dr. Walker.

16 DR. WALKER: No further comments.

17 DR. YASZEMSKI: Thank you.

18 Dr. Silkaitis.

19 DR. SILKAITIS: Yes, the proposed
20 indications is very similar or almost identical to
21 the one that was reviewed a year ago, so that's
22 acceptable.

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1 DR. YASZEMSKI: Thank you, Dr.
2 Silkaitis.

3 Mr. Dillard.

4 MR. DILLARD: No comments.

5 DR. YASZEMSKI: Thank you.

6 Dr. Skinner.

7 DR. SKINNER: Harry Skinner.

8 I only wanted to add, as I said in my
9 previous presentation, and in whom other --

10 MR. DEMIAN: Excuse me. We're having
11 trouble hearing Dr. Skinner over here. Like
12 perhaps his microphone's not working?

13 DR. ABOULAFIA: Aboulafia.

14 Other methods likely to fail.

15 DR. SKINNER: Yes, that's it.

16 Thank you.

17 (Laughter.)

18 DR. YASZEMSKI: Thank you, Dr. Skinner.

19 Dr. Larntz.

20 DR. LARNTZ: The only comment is that
21 there's not much clinical information to change
22 anything and it's clear that this device has to be

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1 used sparingly given the lack of clinical
2 information.

3 DR. YASZEMSKI: Thank you, Dr. Larntz.

4 Dr. Laurencin.

5 DR. LAURENCIN: I have to agree with Dr.
6 Aboulafia. I wouldn't want to tie the orthopedic
7 surgeon to having to be second-guessed at the end
8 as to whether there was another method that might
9 have been possible to work, but may have taken,
10 say, ten hours to perform in a patient that may
11 have a revision after some metastatic tumor where
12 the original -- a lot of bone loss where the
13 original operation was done and the patient -- they
14 want to get the patient off the table for the
15 patient's health.

16 So I think that some midway has to come
17 in where -- a midpoint has to be achieved where
18 perhaps all other options have been considered and
19 perhaps some language where all options have been
20 considered and this option has been deemed best for
21 the particular patient.

22 DR. YASZEMSKI: Thank you, Dr.

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1 Laurencin.

2 Dr. Yaszemski here.

3 I'd like to -- Mr. Dillard, I'm sorry.

4 MR. DILLARD: Jim Dillard.

5 I thought I might just give you a
6 process option in this case that has been used in
7 the past. If, contained within the indications for
8 use, you want to give a little bit more
9 flexibility, one of the ways that we have handled
10 that is to either include warnings, other
11 contraindications if so noted, or precautions that
12 might be additionally helpful to a surgeon that can
13 also be used as special controls in order to get a
14 point across if you believe that it would be
15 appropriate for all of the products of the category
16 type.

17 So I thought I'd just lay out as a
18 potential option that you might want to consider.

19 Thank you.

20 DR. YASZEMSKI: Thank you, Mr. Dillard.

21 Dr. Yaszemski here.

22 I'd like to summarize now the panel's

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1 discussion regarding question two. We feel that
2 the proposed indications as listed are appropriate,
3 with the additions suggested by Drs. Aboulafia and
4 Skinner, of a transmission to the surgeon that all
5 other non-constrained options should have been
6 considered or are likely to fail.

7 With this, to FDA, have we adequately
8 answered question two for you?

9 MR. DILLARD: Yes, thank you.

10 DR. YASZEMSKI: Thank you, Mr. Dillard.

11 Let us proceed now to question three.
12 Question three relates to item number five on the
13 supplemental data sheet.

14 Question number three reads, "Risks to
15 health have been identified by the petitioner,
16 previous panel and the medical device reports.
17 Have all the risks to health for a constrained hip
18 prosthesis been identified? If not, what
19 additional risks should be described?"

20 Dr. Besser.

21 DR. BESSER: No comment at this time.

22 DR. YASZEMSKI: Thank you.

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1 Dr. Cheng.

2 DR. CHENG: I think they've been
3 identified.

4 DR. YASZEMSKI: Thank you.

5 Dr. Hannaford.

6 DR. HANNAFORD: No comment.

7 DR. YASZEMSKI: Thank you.

8 Dr. Aboulafia.

9 DR. ABOULAFIA: Agree with Cheng.

10 DR. YASZEMSKI: Thank you.

11 Dr. Walker.

12 DR. WALKER: It's a very comprehensive
13 list. Nothing needs to be added.

14 DR. YASZEMSKI: Thank you.

15 Dr. Silkaitis.

16 DR. SILKAITIS: No additional comment.

17 DR. YASZEMSKI: Thank you.

18 Mr. Dillard.

19 MR. DILLARD: No additional comments.

20 DR. YASZEMSKI: Thank you.

21 Dr. Skinner.

22 DR. SKINNER: No additional comments.

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1 DR. YASZEMSKI: Thank you.

2 Dr. Larntz.

3 DR. LARNTZ: No comment.

4 DR. YASZEMSKI: Thank you.

5 Dr. Laurencin.

6 DR. LAURENCIN: Agree with the above.

7 DR. YASZEMSKI: Thank you.

8 Dr. Yaszemski here.

9 I'll summarize then that the panel is in
10 agreement that all the risks to health have been
11 adequately identified and no additional risks or
12 cautions need to be added.

13 To FDA, Mr. Dillard, have we adequately
14 answered question four for you?

15 MR. DILLARD: Yes, you have. Thank you.

16 DR. YASZEMSKI: Thank you.

17 We've now discussed all the questions
18 that the FDA has posed to us, and we now come to
19 the task of proposing answers -- that is, filling
20 in of the general worksheet and the supplemental
21 worksheet. And I would ask at this time whether
22 anyone on the panel has a specific wording that

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1 they feel would be appropriate for the supplemental
2 data sheet.

3 If not, I'll try to summarize it from
4 the discussions that we've had, and then we'll ask
5 if there might be a motion to accept the worksheets
6 as filled out.

7 With respect to item one on the
8 worksheet, the generic type of device, we feel
9 that, in addition to the description proposed by
10 the petitioners, it would be perhaps useful to
11 include a notice to the surgeon, a warning to the
12 surgeon that there is not scientific evidence that
13 supports effectiveness in cemented or biologic
14 fixation instances and that perhaps some
15 consideration should be given to providing
16 immediate resistance to tensile forces at the time
17 of insertion.

18 Do I have comments from the panel
19 regarding that wording and whether folks feel it's
20 appropriate or inappropriate?

21 Dr. Cheng.

22 DR. CHENG: Well, I might disagree with

1 the wording that the FDA's acting on something
2 without any scientific evidence.

3 DR. YASZEMSKI: May I ask for a proposal
4 as to how it would be most effectively reworded?

5 DR. CHENG: I might indicate that there
6 is limited experience in the use of these devices,
7 and therefore they be considered for usage only
8 when all other options have been exhausted.

9 And then, I might add, unless clinical
10 indications indicate otherwise, or suggest
11 otherwise -- such as the cases that Dr. Aboulafia
12 mentioned and so forth.

13 DR. YASZEMSKI: So other comments on
14 that?

15 Would it be appropriate, Dr. Cheng, to
16 add some statement about consideration for
17 immediate resistance to tensile forces as Dr.
18 Skinner has mentioned?

19 DR. CHENG: Yes, I would agree to that.

20 But I might also bring up -- Dr. Skinner and Dr.
21 Laurencin, are you referring to putting screws into
22 cups when the cup is originally put in as a

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1 revision case, or what about an existing, well
2 fixed, ingrowth cup and you go to change the liner;
3 do you think you need to add screws or not add
4 them?

5 I don't know the answer to that
6 question.

7 DR. YASZEMSKI: Dr. Skinner.

8 DR. SKINNER: Well, again, I was trying
9 to be vague on the type of fixation that we're
10 talking about. Anybody who has removed one of the
11 relatively smooth coated, hydroxyapatite-coated
12 cups knows that at revision it's a wonderful
13 revision to do because the cup just pops out. It's
14 very nice from that viewpoint.

15 In those cases, there's no resistance to
16 tension. In that situation, if the cup doesn't
17 come out or is going to be difficult to come out
18 for some other reason, then perhaps an additional
19 screw or two might be necessary to resist the
20 tension.

21 If it comes out easily, then it would be
22 easy to put in another cup. Some of the cups --

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1 for instance, the beaded cups, Howmedica, the fiber
2 metal from Zimmer, etc. -- those, if bone grows
3 into them, will provide a tensile load, a tensile
4 resistance that, after their ingrowth, there won't
5 be any problem with having additional screws.

6 That will take care of it in that
7 situation with or without screws. Those are hard
8 to get out.

9 DR. LAURENCIN: I'm mainly referring to
10 initial fixation for --

11 DR. YASZEMSKI: Excuse me, Dr. Laurencin
12 speaking.

13 DR. LAURENCIN: Dr. Laurencin, I'm
14 sorry.

15 I'm referring really to initial fixation
16 of the cup than a new cup being placed in the
17 location.

18 DR. YASZEMSKI: Thank you, Dr.
19 Laurencin.

20 Other comments on the generic type of
21 device? Let's move to number four, indications, on
22 the supplemental data sheet. The proposal we have

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1 is for that recommended by the petitioner with the
2 addition of "all other options to constrained hips
3 have been considered and deemed not appropriate."

4 Comments on this, which will be number
5 four?

6 Dr. Skinner.

7 DR. SKINNER: Just one. I would change
8 hips to acetabular components.

9 DR. YASZEMSKI: Thank you. So noted.

10 Other comments on number four?

11 DR. ABOULAFIA: Aboulafia.

12 You said all other options have been
13 considered and deemed inappropriate. Do we need
14 the "and deemed inappropriate?"

15 DR. YASZEMSKI: It would be fine with me
16 to just say considered.

17 Yaszemski.

18 Thank you. We'll move to number five,
19 identification of any risk factors presented by
20 device. I propose that we fill this in as proposed
21 by the petitioner.

22 Comments on this?

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1 With that, I believe we've given
2 consideration and have come to consensus on what
3 needs to be included in the general classification
4 sheet and the supplemental data sheet. Might I ask
5 if there's a motion for reclassification at this
6 time from the floor?

7 Dr. Skinner.

8 DR. SKINNER: Dr. Yaszemski, I would
9 like to move that we recommend reclassification to
10 Class II for these type of devices.

11 DR. YASZEMSKI: Thank you, Dr. Skinner.

12 Is there a second to this motion?

13 DR. LAURENCIN: Laurencin to second.

14 MR. DILLARD: Excuse me.

15 DR. YASZEMSKI: Mr. Dillard.

16 MR. DILLARD: Yes, Dr. Yaszemski, a
17 point of process. If you wouldn't mind, I think it
18 would be helpful to actually go through the entire
19 supplemental data sheet and have some verbiage for
20 the record that we can make sure that we fill in
21 there before moving towards a vote.

22 DR. YASZEMSKI: Thank you, Mr. Dillard.

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1 MR. DILLARD: Thank you.

2 DR. YASZEMSKI: Mr. Melkerson, could I
3 ask you to put those up that we discussed, and I'll
4 suggest that I'll read them as they're put up and
5 be certain that everybody agrees with them.

6 For the supplemental data sheet under
7 number one, we're going to say constrained total
8 hip arthroplasty devices. The additions that we
9 discussed for number one we will put down in number
10 nine, identification of any needed restrictions on
11 the use of the device.

12 And we'll include -- Mr. Melkerson, may
13 I ask you to put the proposed classification one up
14 in which we put the verbiage on the bottom so that
15 I can read that as the number nine?

16 We are going to add on one of the
17 proposed restrictions that the surgeon should
18 consider providing immediate resistance to tensile
19 forces in the case of initially fixed biologic
20 acetabular cup -- biologic fixation acetabular
21 cups.

22 Thank you, Mr. Melkerson. May I ask you

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1 to put up the indications as put forth by the
2 petitioner?

3 This will be number four on the
4 supplemental data sheet. It will be as proposed by
5 the petitioner with the addition that "all other
6 options to constrained cups have been considered."

7 And we'll change hips to cups there, Mr.
8 Melkerson, please. And under number five, we will
9 fill the supplemental data sheet in with "risks as
10 proposed by the petitioner."

11 Mr. Dillard, does that adequately answer
12 your verbiage question?

13 MR. DILLARD: Yes. And if you wouldn't
14 mind continuing through the sheet -- Mark, if you
15 would put up supplemental data sheet.

16 DR. YASZEMSKI: Thank you. Thank you,
17 Mr. Dillard.

18 MR. DILLARD: Could I make one other
19 point of order, Mr. Chairman?

20 DR. YASZEMSKI: Yes.

21 MR. DILLARD: Just to remind all the
22 panel members to make sure that they are filling

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1 out their own sheet because we will collect it at
2 the end.

3 Thank you.

4 DR. YASZEMSKI: Thank you, Mr. Dillard.

5 Mr. Melkerson, we'll go through specific
6 hazards to health or as proposed. Number six,
7 recommended advisory panel classification, the
8 motion and the second are for classification into
9 Class II and with high priority.

10 Number seven, I would propose we say "as
11 presented by the petitioner."

12 And for number eight, "as presented by
13 the petitioner."

14 In number nine, Mr. Melkerson, I would
15 ask you to add the statement that we put on the
16 petitioner's classification proposal with respect
17 to providing resistance against tensile forces.

18 As Mr. Melkerson is filling this out, I
19 would ask, Dr. Skinner, is this an adequate
20 representation of your motion?

21 DR. SKINNER: Yes.

22 DR. YASZEMSKI: And Dr. Laurencin, the

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1 motion that you seconded?

2 DR. LAURENCIN: Yes.

3 DR. YASZEMSKI: Thank you.

4 It has been moved and seconded that the
5 constrained total hip arthroplasty devices be
6 classified into Class II as outlined on the
7 supplemental data sheet that we have in front of
8 us. I'm going to go around the table now and ask -
9 -

10 MS. SHULMAN: Excuse me.

11 DR. YASZEMSKI: Yes.

12 MS. SHULMAN: Marjorie Shulman, FDA.

13 DR. YASZEMSKI: Ms. Shulman.

14 MS. SHULMAN: There's a back part to the
15 supplemental data sheet.

16 DR. YASZEMSKI: Thank you, Ms. Shulman.

17 MS. SHULMAN: It's quick.

18 DR. YASZEMSKI: Number ten, the device
19 is not Class I, so it's not applicable.

20 MS. SHULMAN: Also, as a matter of
21 housekeeping, these forms have to be updated, but
22 you can vote for a Class II to be exempt from

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1 510(k).

2 DR. YASZEMSKI: Thank you.

3 Number 11, existing standards applicable
4 to the device, device of assemblies, or device
5 materials. I would ask FDA if there's any
6 particular information that we need to put in this?

7 MR. DILLARD: Jim Dillard, FDA.

8 You may reference the petition here, as
9 you've done in others. And then, if there are any
10 others you would like to reference that are not
11 included in that list, we could note them here.

12 DR. YASZEMSKI: Yaszemski.

13 I would suggest that we state for number
14 11 "as per the petitioner's proposal."

15 Dr. Besser.

16 DR. BESSER: Dr. Besser.

17 I'd like to also include reference for
18 the preclinical testing to include stem types of
19 the type that Dr. Skinner was speaking of where
20 significantly lower pull-out -- or higher pull-out
21 stresses would be expected because of the stem
22 design.

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1 DR. YASZEMSKI: Dr. Yaszemski here.

2 Mr. Dillard, the petitioners mentioned
3 testing that has been done. Would it be such that
4 we could include Dr. Besser's recommendation in the
5 testing information as put forth by the petitioner
6 without making it a specific requirement for
7 approval?

8 MR. DILLARD: Jim Dillard.

9 Yes, you may do that. It also helps
10 just with the discussion for FDA to note it, and it
11 may be one of those things that we would look for
12 in review of a 510(k). So it does not need to be
13 specifically mentioned as a standard here, but to
14 note for us to take a look at that when we're
15 looking at differential stem designs.

16 DR. YASZEMSKI: I would propose then --
17 and after making this, I'll come back to Dr. Besser
18 to ask if it meets his approval -- that we would
19 not make it a requirement for the approval, but
20 would recommend to FDA, based upon the discussions
21 we've heard from Dr. Besser, Dr. Skinner, and Drs.
22 Brown and Brooker in the presentation regarding

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1 lever-out, pull-out, range of motion and arc of
2 motion, that we would make a recommendation to the
3 FDA that they should include these things and
4 recommend to the manufacturers that they come to
5 agreement on appropriate values for these and give
6 consideration to them as a group, but not to make
7 them an absolute requirement for reclassification
8 into Class II.

9 Dr. Besser, would that satisfy you?

10 DR. BESSER: Dr. Besser.

11 Yes, that would be satisfactory.

12 DR. YASZEMSKI: Thank you, Dr. Besser.

13 And Mr. Dillard will -- we will say "as
14 proposed by petitioner without including testing to
15 address stem types. And we'll make that a
16 recommendation to you, but not part of the criteria
17 for reclassification.

18 Dr. Larntz.

19 DR. LARNTZ: Kinley Larntz.

20 Just to make sure we're perfectly clear,
21 the two approved devices have apparently very
22 different behavior when they're actually used out

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1 in the world, at least according to our limited
2 data. And we want to make sure -- I just want to
3 make sure everyone's aware that it looks like the
4 two approved devices are quite diverse with respect
5 to, for instance, dislocation rate, which is the
6 primary item that we had information on.

7 I don't know that there's anything that
8 needs to be done about that, but I want the panel
9 to be very aware of that and go from there.

10 DR. YASZEMSKI: Thank you, Dr. Larntz.

11 So noted.

12 Dr. Yaszemski here.

13 I'll restate that we have a motion to
14 reclassify constrained total hip arthroplasty
15 devices -- and a second to that motion -- into
16 Class II with the particular specifications as
17 outlined on the supplemental data sheet.

18 And I would like to go around the room
19 now and ask each panel member to provide their
20 vote, yes or no, for this motion as it appears on
21 the supplemental data sheet, and to offer a reason
22 for their vote.

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1 Dr. Besser, we've been starting with
2 you. May I ask you again to begin?

3 MR. DILLARD: Dr. Yaszemski?

4 DR. YASZEMSKI: Mr. Dillard.

5 MR. DILLARD: Thank you. I hate to
6 intervene.

7 DR. YASZEMSKI: Please do.

8 MR. DILLARD: A point of clarification
9 in process again. Just to make sure that everybody
10 understands, we have to vote on both of the sheets,
11 both the supplemental data sheet and the original
12 sheet.

13 It might be helpful to take them in the
14 opposite order in which you want to take them.

15 DR. YASZEMSKI: Dr. Yaszemski or Mr.
16 Dillard, should we vote twice then? Vote twice?

17 MR. DILLARD: Yes, please.

18 DR. YASZEMSKI: Would it be appropriate
19 from the FDA's perspective to begin the vote with
20 the supplemental data sheet vote? Or should we
21 vote with the general first?

22 MR. DILLARD: Jim Dillard. I believe it

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1 would be better to start with the general device
2 classification questionnaire and then go to the
3 supplemental data sheet.

4 DR. YASZEMSKI: Mr. Melkerson, could I
5 ask you to put the general device questionnaire up
6 so that we can look at it.

7 All again, we will call for a vote.

8 We will go around the room twice,
9 Yaszemski here, and vote first on the general
10 device classification sheet as it appears in front
11 of us.

12 I will start with Dr. Besser again.

13 DR. BESSER: I vote for the motion based
14 on the discussion of the past two hours.

15 DR. YASZEMSKI: Dr. Cheng?

16 DR. CHENG: I vote for approval.

17 DR. YASZEMSKI: Dr. Hannaford?

18 DR. HANNAFORD: I am going to abstain
19 entirely due to my own lack of expertise on this
20 topic.

21 DR. YASZEMSKI: Dr. Aboulafia?

22 DR. ABOULAFIA: I will vote for

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1 approval.

2 DR. YASZEMSKI: Dr. Walker?

3 DR. WALKER: I vote for approval.

4 DR. YASZEMSKI: Thank you. Dr. Skinner?

5 DR. SKINNER: I vote for approval.

6 DR. YASZEMSKI: Dr. Larntz ?

7 DR. LARNTZ: I vote for approval.

8 DR. YASZEMSKI: Dr. Laurencin?

9 DR. LAURENCIN: I vote for approval.

10 DR. YASZEMSKI: The vote is seven yes
11 and one abstention. The motion passes for the
12 general data sheet.

13 We will now move to the supplemental
14 data sheet. I would ask Mr. Melkerson to put it up
15 again.

16 This vote will be for the supplemental
17 data sheet, as filled out.

18 Dr. Besser?

19 DR. BESSER: Dr. Besser. Yes.

20 DR. YASZEMSKI: Dr. Cheng.

21 DR. CHENG: I vote to approve. No
22 further comments.

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1 DR. YASZEMSKI: Dr. Hannaford?
2 DR. HANNAFORD: Abstain, as before.
3 DR. YASZEMSKI: Dr. Aboulafia?
4 DR. ABOULAFIA: Approve, as is.
5 DR. YASZEMSKI: Dr. Walker?
6 DR. WALKER: Yes.
7 DR. YASZEMSKI: Dr. Skinner?
8 DR. SKINNER: I vote yes.
9 DR. YASZEMSKI: Dr. Larntz?
10 DR. LARNTZ: Yes.
11 DR. YASZEMSKI: Dr. Laurencin?
12 DR. LAURENCIN: I vote for approval.
13 DR. YASZEMSKI: The vote is seven yes,
14 one abstention, and the motion for the supplemental
15 data sheet passes.
16 FDA. The recommendation of the panel is
17 that the general data sheet and supplemental data
18 sheet, as presented to you for reclassification
19 into Class II of Constrained Total Hip Arthroplasty
20 Devices has passed, and we recommend to you that
21 they be classified as Class II devices.
22 Mr. Dillard?

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1 MR. DILLARD: Yes, Dr. Chairman. Could
2 I ask for one more, very quickly, could you just go
3 around and ask people to state for the record what
4 their reasons were for an approvability vote or
5 abstention, in terms of the two sheets?

6 Thank you.

7 DR. YASZEMSKI: Thank you, Mr. Dillard.

8 Dr. Besser?

9 DR. BESSER: Dr. Besser. As previously
10 stated in the discussion of the last two and a half
11 hours, I think this is an important product to be
12 made available to orthopedic surgeons in those
13 limited situations where they are going to need it.

14 DR. YASZEMSKI: Thank you, Dr. Besser.

15 Dr. Cheng?

16 DR. CHENG: I think I would tell the FDA
17 that I think it is a useful device in limited
18 situations to be considered when other means for
19 dealing with recurring dislocation have either been
20 exhausted or are not indicated, due to the
21 patient's clinical condition.

22 My only concern about the

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1 reclassification of this product is that surgeons
2 will have a very low threshold to suddenly reaching
3 for the shelf and using this, perhaps when it is
4 not in the patient's best interest, but because the
5 surgeon feels that it is the easiest way out of a
6 very difficult situation, and then it might be used
7 inappropriately.

8 So, I would want to try to prevent that.

9 I think that is the general feeling that I heard
10 this morning, in putting in some of these
11 safeguards.

12 DR. YASZEMSKI: Thank you, Dr. Cheng.

13 Dr. Hannaford, might I ask for your
14 reasons for the two abstention votes?

15 DR. HANNAFORD: I will briefly
16 elaborate.

17 The abstention is not meant to reflect
18 on either the devices in question or the process
19 that is going on here.

20 It is just the fact that I don't feel my
21 own knowledge on this topic is sufficient to give a
22 quality vote in either direction.

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1 DR. ABOULAFIA: I would summarize the
2 discussion really, as --

3 DR. YASZEMSKI: Excuse me, this is Dr.
4 Aboulafia.

5 DR. ABOULAFIA: I would summarize, and
6 to paraphrase someone else's words, it is a simple
7 solution to a difficult problem.

8 And to summarize Dr. Cheng's remarks,
9 you don't get something for nothing. And I think
10 we achieved the goals that we intended to set out.

11 DR. YASZEMSKI: Thank you, Dr.
12 Aboulafia.

13 Dr. Walker?

14 DR. WALKER: I think Dr. Besser and Dr.
15 Cheng have both given exactly the same reasons that
16 I would give, and that is why I voted yes.

17 DR. YASZEMSKI: Thank you, Dr. Walker.

18 Dr. Skinner?

19 DR. SKINNER: I agree with what has been
20 said. I think that the discussion and the data
21 provided by the petitioner were adequate to verify
22 the validity of the conclusion we have come to.

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1 DR. YASZEMSKI: Thank you, Dr. Skinner.

2 Dr. Larntz?

3 DR. LARNTZ: I actually think that the
4 information provided by the petitioner was
5 inadequate, but I certainly appreciate the
6 expertise of the panel members who provided
7 adequate information for reclassification.

8 DR. YASZEMSKI: Thank you, Dr. Larntz.

9 Dr. Laurencin?

10 DR. LAURENCIN: I have nothing more to
11 add.

12 DR. YASZEMSKI: Thank you, Dr.
13 Laurencin.

14 One housekeeping item before we adjourn
15 and that is that we finished a bit ahead of
16 schedule, but we are going to need to stick to the
17 afternoon schedule and start at 1:30 p.m.

18 However, I would ask everybody to please
19 be back in plenty of time so that we can actually
20 start at 1:30, rather than just start assembling at
21 1:30.

22 With that, we will conclude the morning

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1 session and adjourn.

2 (Whereupon, the morning session

3 adjourned at 11:41 a.m.)

4

5

6

1 A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

2 (1:31 p.m.)

3 DR. YASZEMSKI: Well, now, I think we
4 are ready to begin.

5 May I have your attention please? We
6 are going to begin the afternoon session. May I
7 ask everybody to take their seat and we are going
8 to get started at this time?

9 We will now proceed with the open public
10 hearing session of this meeting.

11 I would like to ask at this time that
12 all persons addressing the panel come forward and
13 speak clearly into the microphone, as the
14 transcriptionist is dependent on this means of
15 providing an accurate record of this meeting.

16 We are requesting that all persons
17 making statements during the open public hearing of
18 the meeting, disclose whether they have financial
19 interests in any medical device company.

20 Before making your presentation to the
21 panel, in addition to stating your name and
22 affiliation, please state the nature of your

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1 financial interest, if any.

2 We have one group wishing to address the
3 panel, and at this time I would like to invite
4 Christina Gabriel, president and CEO of CASurgica,
5 Inc. to provide her comments.

6 DR. GABRIEL: Good afternoon. My name
7 is Christina Gabriel, and I am the new, as of a
8 month ago, president and CEO of CASurgica, which is
9 a very small company in Pittsburgh.

10 The company was founded by an orthopedic
11 surgeon and a civil engineer. Anthony DiGiola is
12 an orthopedic surgeon and the engineer is Branislav
13 Branco Jaramaz.

14 They founded the company in 1997 to
15 follow on from over six years of research that has
16 been done collaboratively between Carnegie Mellon
17 University's Robotics Institute and UPMC Shadyside
18 Hospital in Pittsburgh.

19 I should state, therefore, that I do
20 have a financial interest in this company. The
21 company doesn't yet have a product, but we intend
22 to have a product sometime, and it will probably be

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1 in this field.

2 So, this meeting today is timely and of
3 great interest to us.

4 Thank you very much for the opportunity
5 to make a brief statement about issues that we
6 believe that the regulatory process should consider
7 in evaluating devices and technologies for
8 computer-assisted surgery.

9 Our perspective on these issues has been
10 developed during more than six years, as I said, of
11 research at the Carnegie Mellon University Robotics
12 Institute and University of Pittsburgh Medical
13 Center, Shadyside Hospital in Pittsburgh,
14 Pennsylvania.

15 At these research centers, orthopedic
16 surgeons collaborate closely with researchers in
17 computer science and engineering to develop
18 advanced surgical tools and technologies that will
19 hopefully improve patient's outcomes.

20 As part of this collaboration, Shadyside
21 Hospital maintains what they call the Total Joint
22 Registry which includes a general clinical and

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1 radiographic data base for patients undergoing
2 total hip or total knee replacement surgery and
3 knee arthroscopies to facilitate the evaluation of
4 joint reconstructive procedures.

5 Patients are evaluated pre-operatively
6 as well as post-operatively at three months, six
7 months and annually thereafter.

8 As part of the research program, an
9 image-guided surgical planning and navigation
10 system for total hip replacement surgery is
11 undergoing a clinical trial at the hospital with
12 about 100 total hip replacement procedures having
13 been performed to date, using the computer-assisted
14 system.

15 Our statement really is as follows; we
16 really have pretty much one point to make.

17 The surgical goal, as all the surgeons
18 in the room know, is to enable the patient to
19 recover as fully as possible as quickly as possible
20 with as few complications as possible.

21 Current surgical practice is a loosely
22 connected and sometimes uncoupled sequence of

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1 events. Diagnosis and planning, surgical execution
2 of the plan and monitoring of the patient's
3 recovery over time.

4 All of us would no doubt agree that the
5 reason we are developing these new technologies is
6 so that the surgeon will be able to accomplish the
7 surgical task and achieve the surgical goal more
8 successfully than is possible using current,
9 unassisted surgical practice.

10 Therefore, we believe that one of the
11 key factors that the regulatory process should take
12 into account in evaluating any system designed to
13 assist surgical interventions is the level of
14 control maintained by the surgeon.

15 There is a broad spectrum of available
16 and proposed technology, from passive systems to
17 semi-active systems to fully active or robotic
18 systems.

19 We would define passive systems as those
20 that provide the surgeon with additional
21 information prior to and during a procedure, but do
22 not perform an action.

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1 Active systems are capable of performing
2 individual tasks or entire procedures autonomously.

3 In between these two extremes, semi-
4 active systems are ones in which the surgical
5 actions are constrained by a robotic system but the
6 surgeon remains in control.

7 Our research program has emphasized
8 collaboration between computer scientists and
9 engineers who understand what the technology can do
10 well, and orthopedic surgeons who understand what
11 trained and experienced humans do well.

12 We think a good design for these systems
13 is one in which the machine's capability is coupled
14 with human judgement and skill in order to perform
15 a task better than either could do alone.

16 The systems should be designed from the
17 surgeon's point of view so that it is easy to use
18 as a part of the normal flow of the surgical
19 procedure.

20 Passive computer-assisted surgery
21 provides the surgeon with richer information to
22 draw upon during pre-operative planning and the

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1 procedure itself, but leaves all decision-making
2 and control to the surgeon.

3 Therefore, we believe that the safety
4 considerations for patients, when such passive
5 systems are used will be significantly different
6 from those associated with active systems that
7 replace any of the surgeon's traditional or typical
8 actions, at any point.

9 That is really all we wanted to say
10 today.

11 Thank you.

12 DR. YASZEMSKI: Thank you, very much.

13 Do we have anyone else who would like to
14 address the panel, at this time, from the public?

15 Seeing no hands, we will now proceed to
16 the open public hearing session regarding the
17 development of computer-controlled surgical
18 systems, designed for use in orthopedic procedures.

19 First the FDA will present their chosen
20 points and questions. This will be followed by the
21 lead panel reviewers and then we will have a
22 general discussion.

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1 I would like to begin by asking Mr. Neil
2 Ogden, branch chief of the general surgical branch,
3 to provide the FDA presentation and questions.

4 Mr. Ogden?

5 MR. OGDEN: Thank you, Mr. Chairman.

6 (PAUSE)

7 Thank you.

8 I am Neil Ogden and I am branch chief
9 for the general surgical devices branch, here at
10 the FDA.

11 I have a little cartoon here which
12 actually was talked about by Dr. Gabriel very well;
13 thank you for that.

14 The little cartoon there on your right
15 is where we would like to see patients; healthy,
16 fit, physically active. As surgical procedures
17 have been developing and surgical tools, as we will
18 see here today, they have been getting increasingly
19 more complicated.

20 Often times now there is pre-op
21 scanning, imaging, and that information is then
22 used via computer systems and software to be mapped

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1 on to patient's anatomies.

2 That information is then taken into the
3 surgery and hopefully it will facilitate rapid
4 healing and recovery.

5 I am first going to talk a little bit
6 about the history of these devices in the agency,
7 then discuss technology a little bit, then some of
8 our concerns and then we will go over the questions
9 we have provided to the panel.

10 Pre-70's and in the 1970's typically
11 surgical devices consisted of manual clamping
12 systems, sometimes it was basically a ring attached
13 to a surgical table and clamps and manipulators
14 were then screwed down onto that to hold them in
15 place.

16 These could hold various clamps, scopes,
17 retractors. An example would be the Iron Intern or
18 a Brookwalter clamp. Pretty simple technologies,
19 easy for an engineer like me to understand, forces
20 loading.

21 Through the 1980's the companies started
22 to develop gas-powered arms where various gases are

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1 used to control locking joint mechanisms.
2 Sometimes these were fairly complex, sometimes
3 simple.

4 Then in the 1990's, companies started to
5 integrate computer systems and sophisticated
6 software. They started using sophisticated
7 motorized systems with feed-back loops,
8 incorporating memory for surgical tools and arms,
9 putting on actuators.

10 They were also doing a lot of pre-op
11 planning, and using software to map the pre-op
12 anatomy of the patient onto a real-time anatomy of
13 the patient, using that to facilitate a surgical
14 procedure.

15 So, going from the simple mechanical
16 systems, now we have the technology today that
17 consists of computer-assisted, which involves the
18 software, the computer hardware, monitors and
19 control interfaces which could be touch-screens or
20 could be voice-activation, could be hand-held
21 pendants. We have seen a lot of different
22 scenarios.

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1 Often times it is using pre-operative
2 planning, various imaging modalities, MRIs, CTs,
3 ultrasound is now starting to be used and that is
4 being digitized.

5 It is taken into the OR and used to
6 overlay on the patient during real-time procedures.

7 Oftentime this also incorporates
8 databases of implant specifications.

9 And last but not least, robotics.
10 Companies are developing systems now that actually
11 assist in performing the procedures as well.

12 Here is another kind of categorization
13 of what these technologies are. This is sort of
14 hierarchical because the systems on the bottom also
15 typically incorporate all the ones that came before
16 it.

17 Dr. Gabriel talked about her system of
18 describing these, and that is a good one as well.

19 Typically, the first category, computer-
20 assisted retractor holder, an example was given in
21 your panel packs of the Robotrac system. It is a
22 fairly simple retracting device that surgeons have

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1 used in orthopedic procedures.

2 Then computer-assisted operative
3 planning machines. Actually, Dr. Gabriel's group
4 has been developing one of these. I believe it is
5 called the Hip-Nav System with Dr. DiGiola.

6 This machine is used with the pre-
7 operative imaging and planning, and sort of maps
8 out the best positioning of the acetabular cup.

9 Then progressing further to more
10 complicated systems. You have systems that then
11 provide the pre-operative planning, the computer
12 analysis.

13 Then when you take them into the OR,
14 like the Hip-Nav as well, they actually provide
15 some kind of physical guidance to the surgeon.
16 Either an alignment mechanism or something of that
17 nature.

18 The most sophisticated systems from our
19 point of view are the computer-assisted operative
20 planning systems that also include surgery
21 performance, where there is a robotic or some type
22 of motorized mechanism tied into the computer

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1 software that actually performs part of the
2 surgical procedure.

3 FDA's concerns about these technologies'
4 risks, could be a technical failure of some kind,
5 and how does this transfer into a risk to the
6 patient.

7 There could be additional safety issues
8 regarding the use of this technology.

9 For instance, does it take longer to do
10 it?

11 Does incorporating this kind of
12 technology into the procedure, does it add a lot of
13 additional steps and increase the difficulty of the
14 procedure?

15 Also, clinical outcome is very
16 important. Does the use of this technology improve
17 the clinical outcome, does it make it about the
18 same but add increased risks during the procedure
19 or is the clinical outcome a little worse than
20 traditional methods?

21 There may be other concerns as well, as
22 far as risks.

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1 Benefits. Well, there could be improved
2 clinical results.

3 There could be improved safety profiles.

4 Using a computer-assisted system may provide the
5 surgeon with enough information to allow them to
6 perform the surgery in a more safe way, perhaps
7 quick, perhaps better aligned.

8 Also, surgeon preferences, having a
9 computer-assisted system may make the procedure
10 much simpler for the surgeon because they may not
11 have to spend as much time during the procedure
12 doing their own alignments, assessing what size
13 prosthetic they need to implant.

14 There may be other concerns as far as
15 benefits, as well.

16 I apologize for the slide not fitting
17 all the way on the screen. There are numbers, if
18 you follow along.

19 So, our concern for the panel is to try
20 to help the FDA understand what types of
21 information we really need to adequately assess
22 these types of technologies.

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1 Our first question is, please discuss
2 the types of issues and engineering concerns that
3 would be important to evaluate these technologies.

4 Mr. Chairman, I am not sure if you want
5 me to read all the questions or do them one at a
6 time and have you respond?

7 Read them all, then respond later?
8 Okay.

9 Number two is, please discuss important
10 clinical study endpoints to consider for evaluation
11 of these types of devices.

12 Please discuss any longer term safety
13 concerns that need to be addressed in the study of
14 these devices.

15 Number three, regarding surrogate
16 endpoints for a computer-assisted surgical
17 technology, are there quantitative and/or
18 qualitative short-term endpoints that could best
19 capture an improvement in the procedure?

20 Number four, what longer-term
21 effectiveness endpoints, including clinical
22 endpoints, would be important to consider in

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1 looking at risk-benefit for these products?

2 Thank you.

3 DR. YASZEMSKI: Thank you, Mr. Ogden.

4 We are going to have a general panel
5 discussion aimed at providing FDA with our
6 recommendations regarding these four questions.

7 I would like to begin this discussion by
8 having our two lead reviewers present their
9 positions.

10 First, I would ask Dr. Walker to lead
11 off the panel's discussion with his pre-clinical
12 review.

13 Dr. Walker?

14 DR. WALKER: Mr. Chairman, it is my
15 understanding that there is one review in the open
16 session and one review in the closed session, am I
17 right?

18 DR. YASZEMSKI: Correct.

19 DR. WALKER: So, I think the second
20 review will be delayed.

21 MR. DILLARD: Mr. Chairman?

22 DR. YASZEMSKI: Mr. Dillard.

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1 MR. DILLARD: Yes, in terms of the open
2 session, I might say something just for the ground
3 rules here is that the open session is for the
4 public, and what is said here is for the general
5 public.

6 The closed session for this afternoon
7 which will be immediately after the open session,
8 will not be for the general public. At this point,
9 no discussion should ensue about what will be
10 discussed in the closed session.

11 This is strictly an open session with
12 general discussion about these topic areas.

13 DR. YASZEMSKI: Thank you, Mr. Dillard.

14 Dr. Walker, does that answer your
15 question?

16 DR. WALKER: Yes.

17 DR. YASZEMSKI: Please proceed.

18 DR. WALKER: Neil, in his presentation
19 immediately before this one from FDA, in the
20 hierarchy of different levels of computer-assisted
21 surgical devices, had as the highest and most
22 complex device one that was a computer-assisted

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1 planning and robotic performance of the surgery.

2 And that is the issue from an engineer's
3 point of view that I would like to address. What I
4 would like to do is lead off for the first part of
5 this into the question of what are the issues and
6 engineering concerns surrounding any sort of a
7 robotic surgical device, and since I am an
8 engineer, this happens to be an engineer's view.

9 It happens that I live in New Orleans,
10 and blizzard season hit last week when it got down
11 to fifty degrees. So, my wife asked me to make a
12 peg board that could go underneath the stairs there
13 the kids could hang up their jackets because they
14 really needed those jackets. It didn't even get
15 above sixty one day.

16 So, my son and I went down to the
17 workshop and grabbed an old mop handle and a piece
18 of 1 x 4 wood, and decided to make some pegs and
19 put them in the wood.

20 There is a reason that I am telling you
21 this story that will come out in a minute.

22 My younger son is ten, and he decided to

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1 do this with a hammer and a screw driver. His
2 approach to putting a diagonal hole into the board
3 he was going to put the peg into was to get the
4 hammer, tap on the screw driver and make a hole
5 that way, in this 1 x 4 piece of wood.

6 My approach, and he was scared to use
7 the electric drill. My approach was just to use an
8 electric drill. But as any of you who have ever
9 done that knows, it is awful hard to drill a hole
10 on a diagonal with an electric drill.

11 What I really should have done if I had
12 wanted to do this with some precision would have
13 been to go over the lab at school where there is a
14 drill press, and clamp the board to the drill
15 press, set up the correct angle, and have a
16 mechanical device track the bit.

17 So, there were three different
18 approaches to putting a hole in a piece of wood and
19 putting a peg in that piece of wood.

20 The three approaches were banging on it,
21 drilling it by hand or using some sort of a
22 controlled device. The controlled device would of

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1 course given me much greater three-dimensional
2 accuracy because I would have been drilling on an
3 angle properly, and I could have, in fact, drilled
4 multiple holes at exactly the same angle, and I
5 wouldn't have gotten as tired as I was fighting the
6 electric drill, my precision would have been
7 higher.

8 Fortunately, for this particular
9 application, I didn't need to do anything inside
10 the hole after I drilled it, except put glue in it.

11 But had I needed to, the robotic
12 approach would have given me that ability. And I
13 certainly didn't need to see inside the hole,
14 although there are many applications, you can
15 imagine, where that direct visualization of the
16 inside of the hole would have had some great
17 benefits for me.

18 So, the analogy between drilling a hole
19 in a piece of wood and doing a robotic surgery is
20 not that farfetched.

21 In order to drill that hole repeatedly,
22 I need to introduce the concept that is familiar to

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1 the engineers here, and I beg your indulgence, and
2 not so familiar to the surgeons, of closed-loop
3 feedback and measurement.

4 Closed-loop feedback and measurement is
5 predicated on the assumption that you want to know
6 where you are, where you are going, and that an
7 automated device figures out how to get from where
8 you are to where you want to be.

9 Drilling a hole, I know that I am at the
10 top of the piece of wood and that I want to go
11 through to the bottom of the piece of wood.

12 Only now we will add into that a
13 measurement of where I am, some sort of a automatic
14 device that says where I am, figures out how fast
15 to advance the drill press, and apply a correction
16 so that the drill goes, in fact, down through wood,
17 in the correct path.

18 Now, when we do that as humans, we are
19 using three complementary sensors to measure the
20 position of the drill and to calculate how much
21 farther the drill has to go.

22 We measure the position of our arms with

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1 sensors in the muscles and parallel with the
2 muscles and in series with the tendons, and we get
3 proprioception.

4 That way, with visual confirmation of
5 position, a mechanical system, a robot, it is very
6 easy to measure the angles of the joint and
7 calculate position in that way.

8 It is also easy to measure the load that
9 is applied by the end effector. For a robotic
10 surgical system, some sort of a fiduciary marker,
11 the analog to visual location is needed so that we
12 can figure out where the effector is in relation to
13 tissue that is being operated on.

14 Hand operation of controllers, of
15 course, is easiest with, for motorized stereotaxy,
16 where the device is simply under the control of the
17 operator, visual feedback is satisfactory.

18 There have been some applications of
19 virtual reality endoscopy for cholecystectomy where
20 there is also continuous feedback, and the operator
21 is at all times visually, either directly or
22 through a camera, seeing where his end effector is

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1 going.

2 A second application that is being
3 proposed for robotic surgery is telesurgery where
4 the issue of delayed visual feedback between the
5 effector and the operator becomes an issue.

6 We will be talking today about
7 programmed operation where the operator really does
8 not see where the hole is being drilled. He has
9 some indirect sensors of where the hole is, but
10 basically, the robot now at this highest level, has
11 taken over control and is going ahead and advancing
12 the effector through the workpiece up until the
13 point that the hole is completely drilled.

14 The effectors, and we can go through
15 that fairly briefly, are either passive or active.

16 The one we will be talking about today is an
17 active effector, the end mill for femoral reaming
18 for cholecystectomy, scissors and sutures, general
19 surgery.

20 The real issue for the engineer is to
21 look at the potential error sources.

22 A surgeon with a tremor obviously not

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1 going to be able to do as effective a job and
2 stability in closed loop feedback systems is a
3 trade-off in measurement between how quickly I can
4 move my workpiece and my effector to where I want
5 it to be, and how quickly I can measure where I
6 have been.

7 A classic example of this is a
8 thermostat that reacts too quickly to a change in
9 heat and suddenly, as you open the door, the
10 thermostat thinks it is freezing cold and heats the
11 room up to 80 degrees before the thermostat has had
12 a chance to recognize that this is not a long-term
13 change in temperature, but merely somebody opening
14 the door and leaving it open for a few seconds.

15 In any engineering system for closed-
16 loop control, there is going to be a trade-off
17 between over-shoot, reacting too quickly, and slow
18 response, which we have talked about.

19 An even more serious control besides
20 tremor, is the loss of proprioception in a robotic
21 surgery system.

22 As soon as a sensor no longer knows

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1 where the work-piece is or where the effector is or
2 where is that drill bit. As soon as we lose
3 control of the knowledge of where that drill bit
4 is, then we no longer know where we are drilling a
5 hole.

6 Then there needs to be some sort of a
7 fail-safe mechanism that will either stop the
8 drilling, retract the work-piece, or have some sort
9 of a redundant sensor that says that if one sensor
10 doesn't know where the hole is, another sensor
11 does.

12 Several fail-safe modes need to be
13 incorporated. Three of those that are commonly
14 used are a watchdog at the start-up to make sure
15 that the system is operating properly, if a failure
16 occurs to freeze the drilling in the last known
17 position, and some sort of a retraction to a safe
18 park-zone.

19 All of those are significant engineering
20 issues that we need to talk about in response to
21 that first panel question.

22 That is it for the initial presentation.

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1 Dr. Hannaford, I think, will do one specific to
2 the closed panel meeting.

3 DR. YASZEMSKI: Thank you very much, Dr.
4 Walker.

5 I would like to now ask for Dr.
6 Laurencin to present the clinical review.

7 DR. LAURENCIN: Thank you.

8 Mr. Dillard, Mr. Melkerson, Mr. Demian,
9 thank you for inviting me to present some of my
10 views on robotics.

11 The proposed use of robotics in surgery
12 is every increasing. A number of scientific and
13 clinical developments are probably responsible for
14 this trend.

15 First, the current emphasis on minimally
16 invasive surgery, for example laproscopic
17 procedures as just talked about, have brought great
18 interest in robotics.

19 Robotics offers distinct advantages to
20 stability and the ability to work with precision at
21 small scales, and again, it is well-suited to
22 minimally-invasive needs.

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1 Second, the emergence of sophisticated
2 three-dimensional patient data, usually by CT or
3 MRI, and the software to manipulate these data,
4 have driven increased interest and use.

5 Third, for orthopedic surgery, the
6 successful addressing of previous weak link
7 problems such as implant materials and implant
8 design in the 1970s and 1980s have lead scientists
9 to new areas, in other words, robotics, to improve
10 existing surgical procedures.

11 In general, just as a bit of review
12 implantation of robotically- assisted procedure
13 involves planning, registration and navigation
14 steps.

15 Implanting images are taken of the
16 region of interest and are presented to the
17 clinician in meaningful form.

18 For registration, a correlation of the
19 image data is made with the patient's anatomy.
20 This is often done with fiducials or markers, as in
21 the first generation robotic system for a hip
22 replacement.

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1 Other techniques include optical
2 tracking techniques that can obviate fiducials.
3 That track, for instance the curvature or surface
4 of object and correlate them with image data.

5 Finally, with data correlated to the
6 patient, navigation or guidance can take place.
7 This can be performed by the physician alone, the
8 robot alone, or somewhere in between.

9 The level of involvement of physician
10 versus robot depends upon issues of safety,
11 physician comfort and acceptance, practicality of
12 implantation, also cost.

13 What is the particular attraction to
14 orthopedic surgery?

15 Bone, as a tissue, is relatively facile
16 to manipulate in comparison to soft tissues, and
17 the level of deformity in cutting is relatively
18 low.

19 Thus, on a theoretical basis, one can
20 envision developing surgical procedures where pre-
21 operative plans can correlate with the robotic
22 procedure.

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1 In orthopedic surgery, the system that
2 has received the most attention is the ROBODOC
3 system, a brainchild of the early 1980s. Its goal
4 is to ream the femoral canal more precisely in
5 order to decrease the short term complication of
6 femoral fractures which can occur as part of the
7 reaming, broaching, press/fit implantation
8 procedures of total hip replacement.

9 There is also a strong suggestion that
10 with proper fit and fill from the literature, that
11 long term outcomes will be improved.

12 Also, in orthopedic surgery, the Hip-Nav
13 system has received attention.

14 This guidance system for acetabular cup
15 placement is designed to optimize cup position to
16 minimize the chance of impingement, with subsequent
17 dislocation occurring.

18 A registered pelvis is used in
19 conjunction with the tracking software to provide
20 simulations of range of motion with cup position.

21 Significant interest is present in
22 robotic use in conjunction with total knee

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1 arthroplasty. The robotics range from surgical
2 assistants that hold the knee to those that
3 determine knee alignment and perform bone cutting.

4 Happy mediums have been designed between
5 robot and human implements.

6 For instance, Davis, et al. have
7 designed a cutting system operated by robotic
8 control, but hand-guided by the surgeon.

9 In effect, a virtual jig is formed,
10 placing force to keep the surgeon's hands on track
11 when making bone cuts.

12 Areas of the spine may, in many ways, be
13 some of the most challenging of all work
14 applications of orthopedic robotic technology.

15 The precise placement of pedicle screws
16 present special problems in registration and
17 demands for absolute precision in application.

18 The stakes are large. A robotic system
19 that could be used with confidence might allow the
20 routine use in pedicle screw placement.

21 Where is the technology going? Clearly with
22 advancements in the areas of control, sensor design

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1 and mechanical engineering which we just talked
2 about, the capabilities of these robotic devices
3 will dramatically and we should look forward to
4 their increasing role in surgery.

5 The better question now is where is the
6 technology today?

7 Today's technology does have
8 limitations, from industrial-based mechanical
9 manipulators with only first or second generation
10 optimization, to work in clinical environments, to
11 issues of sterility maintenance.

12 It should be remembered that the same
13 technology that drives robotics is the same
14 technology creating our Y2K anxieties; in other
15 words, the computer.

16 No system can guarantee complete safety
17 in all settings.

18 Inventors have addressed this fact by
19 mechanical design changes such as using the low-
20 pressure pneumatic manipulators, or by placing more
21 control in the hands of surgeons.

22 But that fact still remains.

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1 Physician comfort and acceptability is
2 growing via focus groups, the media and scientific
3 presentations.

4 However, essential questions of how this
5 technology affects my patients outcomes and what
6 are the costs involved, must have no-nonsense
7 answers for the technology to find wide-spread and
8 lasting clinical use.

9 DR. YASZEMSKI: Thank you, Dr.
10 Laurencin.

11 Let's go around the table now, and we
12 will begin with Dr. Silkaitis, and ask each panel
13 member to comment or to ask for clarification from
14 the FDA of informational or procedural points.

15 Dr. Silkaitis?

16 DR. SILKAITIS: Yes. The area of
17 robotics is certainly a large area for
18 consideration.

19 Are we looking at robotics in a specific
20 area of its use? In other words, are we talking
21 about active robotics? Are we talking about semi-
22 active robotics?

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1 DR. YASZEMSKI: Who are you directing
2 the question to, Dr. Silkaitis?

3 DR. SILKAITIS: To FDA.

4 DR. YASZEMSKI: Mr. Dillard, would you
5 care to comment on that?

6 MR. DILLARD: Yes. Jim Dillard.

7 I think the focus here today, or where
8 we would like you to focus your attention
9 predominantly, is on the increasing use of this
10 technology.

11 I think that both Dr. Laurencin and Dr.
12 Walker gave us some examples from the simplistic or
13 the types of technologies that are used today that
14 are not computer-controlled, or minimally computer-
15 controlled, all the way up to those which are under
16 great computer control as well as having a lot of
17 mechanical interactions with them that are under
18 computer control.

19 Our main concern is regarding that end
20 of the spectrum of the technology.

21 We are seeing ever-increasing amounts of
22 devices that we are faced with making either

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1 regulatory decisions on from the stand point of
2 should they be on the market or not, as well as the
3 design of clinical studies in order to evaluate
4 these kinds of technologies.

5 The main focus we would like you to have
6 today is on this area of technology in orthopedics,
7 number one.

8 There are other indications in usage in
9 other areas of medicine, but we would like you to
10 focus on orthopedics.

11 We would also like you to focus on those
12 types of issues, and this is really more of an
13 issues-based discussion I think, from either the
14 engineering and/or the clinical perspective, what
15 are some of the questions that we should be asking.

16 What should FDA be asking?

17 Any guidance that you might have into
18 types and ways to evaluate the technology and the
19 important things to look for will help us.

20 I think we are struggling right now in a
21 lot of areas, trying to design the right clinical
22 studies, as well as what is the right amount of

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1 pre-clinical information that we need in order to
2 evaluate the technology as well as move on to
3 clinical studies.

4 I hope that helps.

5 DR. YASZEMSKI: Thank you, Mr. Dillard.

6 Dr. Silkaitis, with that, what are your
7 thoughts as the perspective of the industry
8 representative regarding either the engineering or
9 the clinical issues?

10 DR. SILKAITIS: In other words, the
11 evaluation or the discussion is centered on the
12 equipment that is being used to perform the surgery
13 as opposed to the evaluation of a device where we
14 are looking at longer-term data.

15 The question is what is the least
16 burdensome amount of data that is necessary to
17 demonstrate that the equipment meets its
18 performance characteristics.

19 So, in a particular case, if the robotic
20 is to drill a hole or drill a cylinder by certain
21 dimension, then we take a look at, and we can
22 easily measure, how precisely it does that, how

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1 often it does it, and what the user errors are
2 involved in achieving that.

3 So, I guess from my perspective is that
4 we are not looking at device designs, but we are
5 looking at equipment performing to its
6 characteristics.

7 DR. YASZEMSKI: Thank you, Dr.
8 Silkaitis.

9 Mr. Dillard, we are coming around. I
10 will give you the opportunity to add again.

11 MR. DILLARD: I think, at this point,
12 that is what I would have added without Dr.
13 Silkaitis' question, so with that I think I will
14 pass.

15 DR. YASZEMSKI: Thank you, Mr. Dillard.

16 Dr. Skinner?

17 DR. SKINNER: Well, I'm certainly not a
18 robotics expert, although I am an orthopedic
19 surgeon so I guess that makes me into something of
20 a robot.

21 I think the issues are the same ones
22 that Dr. Silkaitis mentioned.

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1 If the issue is number one, that we are
2 going to cut a hole or cut a surface, then I think
3 it is a matter of accuracy how closely we come to
4 where we want to cut that hole or surface, and it
5 is a matter of precision as to how precisely we do
6 it each time.

7 And it is a matter in comparison to what
8 a surgeon can do.

9 I know Dr. Bargar has compared himself
10 to a robot at times, and has turned out nearly as
11 good as a robot. Maybe he will comment on that at
12 some point.

13 But, if we are going to get that
14 accuracy and precision that is better than a
15 surgeon, then I think that has to be the criteria.

16 If it were only doing as well as a
17 surgeon, then we have a cost issue to deal with.

18 On the other end of the things, when it
19 comes to comparing this surface we have cut or
20 drilled or whatever with a robot and we compare the
21 clinical results, again I think we have to consider
22 that this is simply a surgical tool, and the

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1 immediate clinical results are the problem we have
2 to deal with. That's the issue.

3 It is not what the results are six weeks
4 later, six months later, six years later.

5 It is a surgical tool and what happened,
6 basically, the day after surgery when you look at
7 the x-rays or whatever criteria you are going to
8 look at.

9 DR. YASZEMSKI: Thank you, Dr. Skinnner.
10 Dr. Larntz?

11 DR. LARNTZ: Well, I'm a statistician.
12 I think I said that this morning. I will say it
13 again, just to make sure we are clear.

14 I am not a robot, I think.

15 But I do have some appreciation for
16 computer technology and I have some concerns about
17 computer technology, as a long-time programmer.

18 I guess I would say there is no such
19 thing as bug-free software. If someone claims that
20 then you have just got someone who is a liar.

21 So, I think we have to very carefully
22 consider that the technology will do what it is

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1 supposed to do. Computer-assisted technology. It
2 is very difficult.

3 Systems get upgraded, and isn't it
4 amazing that every time there is an upgrade what
5 happens to your system? Any ideas? You have all
6 gone through it.

7 Things don't work as well, so you have
8 to be very, very careful.

9 Now, given that caveat, I am incredibly
10 in favor of developing technology-based assistance
11 because why? There is going to be consistency.
12 Whatever this thing does, it does it consistently.

13 We found in lots of areas, consistency
14 is a very good thing, in and of itself, once you
15 understand what the result is. That consistency
16 has incredible value.

17 Look at the cars you drive now compared
18 to what they were 20 years ago. Consistency is
19 incredibly important as a result of the quality
20 movement.

21 So, I think there is an advantage there
22 that could be beneficial in lots of ways.

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1 One of my cardiologist friends would say
2 you might avoid what we call operator error. And
3 operator errors do occur on occasion in surgeries.
4 And sometimes, if something is being done
5 consistently, it will avoid that.

6 From the statistical point of view, how
7 should we evaluate things?

8 We should evaluate these technologies in
9 the same way that we evaluate every other new
10 device, every other new item that we are doing.

11 Does the technology do what it is
12 supposed to do? That is first.

13 And then, what is the benefit of that?
14 Is the benefit to the surgeon? Is the benefit to
15 the patient? Is the benefit to, well, whomever.

16 Now, what kind of benefit can you
17 expect? I think there is a whole range of things
18 we have heard people say. There might be short-
19 term benefits. There might be long-term changes
20 and benefits, too.

21 We have to be very, very careful in
22 evaluating what those would be.

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1 Cost savings or cost increases, sounds
2 like it could go both ways. And there's lots of
3 various things.

4 So, my opinion, short bottom line is we
5 should evaluate these new technologies in the same
6 way we have always evaluated technologies .

7 In fact, we should always evaluate
8 things better than we have been doing, which is to
9 say we should use well-designed studies and carry
10 them out carefully and not just say gee-whiz, wow,
11 this works! Let's do something with this.

12 Be careful, think about it and use the
13 same principles to evaluate these as you would use
14 any other medical device or technology.

15 DR. YASZEMSKI: Thank you, Dr. Larntz.

16 Dr. Laurencin, you presented your
17 review, but I would like to offer you an
18 opportunity at this time to add additional comments
19 that you might have.

20 DR. LAURENCIN: I'll be making comments
21 later this afternoon.

22 Thank you.

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1 DR. YASZEMSKI: Thank you, Dr.
2 Laurencin.

3 Dr. Besser?

4 DR. BESSER: Yes, thank you. In answer
5 to I guess the first -- from the engineering
6 perspective, the mechanical engineer, and I never
7 thought orthopedic surgeons were robots; I knew
8 they were carpenters.

9 So, I very much enjoyed Dr. Walker's
10 reference to drilling holes for pegs for a coat
11 rack.

12 I think some of the important issues
13 that the FDA has to be aware of, and some of the I
14 guess assumptions that we have implicitly made, may
15 or may not be true.

16 First, if there is an ability to
17 visualize directly in real time, so that you can
18 see if your device is not drilling the hole in the
19 right place or at the right angle or is not putting
20 in nails or screws or whatever it is that you would
21 like to do orthopedically, so that you can stop it,
22 then those types of systems you are talking about

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1 are essentially remote-manipulator Waldo kind of
2 system.

3 I think that issues inherent with
4 systems like those are those in any mechanical
5 linkage where you want to look at backlash in the
6 gearing system or the ability to precisely position
7 a device and know that it is going to stay there
8 and be rigidly there and not going to move as you
9 start to use that tool against whatever surface you
10 are working on.

11 That merely by applying pressure to it,
12 your linkage isn't going to deflect or deform or in
13 some way not drill the hole where you want it to be
14 or nail the nail where you want it to be.

15 If you are not able to visualize your
16 end effector and now you are flying blind, then you
17 need a way, before you start to cut, drill or
18 screw, to know that you have positioned that end
19 effector to the accuracy necessary.

20 You have to have some way to address
21 that, either through some imaging system that is
22 used after you have positioned your end effector

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1 and are ready to cut, drill or whatever. I would
2 think that you would have to be able to ensure that
3 you have positioned the end effector appropriately.

4 Possibly, after demonstrating your
5 ability to position that end effector
6 appropriately, 100 times out of 100, then you can
7 allow them to continue using this without that
8 first visualization.

9 I guess I am looking at the safety
10 aspect of this as opposed to the effectiveness
11 aspect.

12 My first concern would be is this safe?
13 Is it going to cut, drill, screw in the wrong
14 place?

15 Then, looking at effectiveness, one
16 issue I would sort of like to throw out to the
17 orthopedic surgeons is we are sort making an
18 assumption that this clinical end point is
19 extremely dependent upon your ability to precisely
20 and accurately cut, drill, screw.

21 We should not require these systems to
22 be more accurate and more precise than is currently

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1 being done by a surgeon.

2 If a surgeon can perform some operation
3 and get good clinical outcomes and is not able to
4 cut to 1/1000 mm or a tenth of a degree, then there
5 is no reason to try to build a machine that can do
6 that.

7 An orthopedic resident friend of mind
8 once told me that the perfect is the enemy of the
9 good.

10 When you are an orthopedic surgeon and
11 you keep working at it, trying to get it absolutely
12 perfect is usually when everything goes south.

13 So, I think that when evaluating systems
14 like this, I am not sure that we should hold them
15 to the standard that they have to be better or more
16 accurate than the skilled orthopedic surgeon.

17 If you can do it as well as the skilled
18 orthopedic surgeon and in less time so that the
19 patient has to endure less time in surgery or
20 making it easier for the orthopedic surgeon to do
21 what he is trained to do, then I think that is a
22 valuable end point and a valuable goal for this,

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1 also.

2 DR. YASZEMSKI: Thank you, Dr. Besser.

3 Dr. Cheng?

4 DR. CHENG: Well, I guess I am of the
5 opinion that surgery is really done in your head,
6 not with your hands.

7 But, these technology-assisted devices
8 can be valuable in performing mechanical tasks in
9 the operating room.

10 So, I guess if the FDA wants to evaluate
11 these, I would encourage the FDA to determine what
12 is the goal of the device? If it is a scalpel, a
13 laser, a coagulator, or whatever it is, does it do
14 what it is meant to do?

15 Secondly, as a result of that, if it
16 meets that goal is it actually meaningful from a
17 clinical standpoint or is it meaningful from a
18 financial standpoint.

19 I think that orthopedic surgeons have a
20 very low threshold, historically, for embracing new
21 technology. However, we have to back away and ask
22 ourselves does this actually makes sense to use

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1 this particular device.

2 That would be the limit of my comments.

3 DR. YASZEMSKI: Thank you, Dr. Cheng.

4 Dr. Hannaford?

5 DR. HANNAFORD: I want to start with a
6 couple of words about industrial robots because
7 many of the initial laboratory systems are based on
8 industrial robots, and some of the commercial
9 systems are based on industrial robots, and a lot
10 of the thinking about robots is based on industrial
11 robots.

12 Industrial robots have a couple of
13 attributes that are driven by their existing
14 markets. An amazing percentage is simply that one
15 task of spot-welding that we see in the auto
16 commercials all the time. That is a huge bulk of
17 all the robots in the market, but not all of them.

18 But the two things that they are sold on
19 and deliver on are accuracy, or more precisely,
20 precision, and reliability. Over the years they
21 have a track record of doing very well on those
22 things.

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1 The reliability requirements of
2 manufacturing are so much greater than any
3 conceivable volume of surgery we could ever see
4 being done, that a robot in manufacturing will have
5 to do that task precisely and stay within specs
6 thousands of times per day and operate for a year
7 or more.

8 So, in the sense of how long will it
9 last and stay in its performance range, that is a
10 much, much more demanding realm than surgery.

11 Now, let's look at safety. Safety is a
12 huge concern in manufacturing as well because the
13 manufacturer is liable, and so forth.

14 But the traditional safety approach in
15 industry and manufacturing is that you put a cage
16 around the robot and you keep out of reach of the
17 robot.

18 That is a very effective approach, but
19 it has no usefulness for robotic surgery.

20 So, we do have to think very, very
21 carefully about safety, even though this base
22 technology that is coming into the OR is already

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1 very reliable.

2 In surgery we have to adopt a totally
3 different safety approach than is used in
4 manufacturing.

5 In particular we want to look at the
6 control system. This has come up in the software
7 comment that we heard.

8 The control systems contribute to the
9 reliability of industrial robots, but are
10 sometimes, to a greater or lesser extent in the
11 different systems I have seen, modified for
12 surgical applications.

13 So, that is where engineering attention,
14 and this now gets me directly to the first question
15 of design review and so forth, should really be
16 focused.

17 The typical approaches are adding extra
18 sensors, redundant sensors, so if a sensor fails
19 that state can be detected right away. Sometimes,
20 such a modification is really an add-on to the
21 intact control system.

22 But other times the system is connected

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1 to something else in such a way that its properties
2 belong to a bigger system and that has to be looked
3 at carefully.

4 Some of these systems have a form of
5 surgical assistance where force information comes
6 back to the surgeon through a control device. This
7 is known as a force feedback system or a bilateral
8 system.

9 That system has to be carefully analyzed
10 as a whole and not just certified based on the
11 safety of all the individual components.

12 Finally, the last point I want to make
13 is training.

14 I think the type of and nature of
15 training of surgeons who will use these systems is
16 very important. It is precisely the reliability of
17 the base technology that I think makes it very
18 important.

19 I am worried about a hypothetical
20 situation where a system may have a big red
21 emergency stop button for a surgeon to use in case
22 of some problem, but it may work so well for a

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1 couple of thousand procedures, that if something
2 does go wrong on the next procedure, the physician
3 may not remember where that E-stop button is.

4 On the other hand I think that these
5 robotic systems present an opportunity for safety
6 because I think they lend themselves, in many ways,
7 to training through simulation which people are
8 working on for conventional surgery, but is very
9 hard.

10 In some cases it is easier to do that
11 kind of training with a robotic system.

12 I think about the example of flight
13 training for pilot, where a pilot will have to
14 practice a situation that is very, very rare, such
15 as having an engine fail during take-off. How many
16 of us have had that happen when we have been on a
17 plane? Very few of us.

18 Probably doesn't happen to most pilots
19 in their whole career. Yet, all of them are
20 trained to do something about it in simulators.

21 I hope that robotic surgical systems
22 will include that kind of training.

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1 That kind of training, if it is done in
2 simulation, can be done periodically, and a surgeon
3 can be recertified. So, that surgeons are actually
4 ready when some very, very rare problem comes up.

5 I really don't view that as a problem
6 with the technology as much as an opportunity to do
7 even better.

8 So, those are my comments at this point.

9 DR. YASZEMSKI: Thank you, Dr.
10 Hannaford.

11 Dr. Aboulafia?

12 DR. ABOULAFIA: I don't have any
13 specific comments right now.

14 DR. YASZEMSKI: Thank you.

15 We have gone around the table now, and I
16 would like to end by asking the two people who were
17 the lead reviewers to close up with any additional
18 comments they have come up with after listening to
19 the discussion.

20 I would like to start with Dr. Walker.

21 Any thoughts after the round table discussion?

22 DR. WALKER: Well, I want to thank Dr.

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1 Hannaforð for adding some additional safety
2 considerations that I didn't include in mine.

3 I think that as we go around the table
4 and consider safety, the points he raised about
5 training, as well, are extraordinarily important.

6 The argument of this device providing
7 greater precision, but the safety issues and the
8 down-sides are what we need to be worried about in
9 the regulatory environment.

10 DR. YASZEMSKI: Thank you, Dr. Walker.

11 Dr. Laurencin, any additional comments?

12 Before we go, let's ask Dr. Skinner.

13 DR. SKINNER: Yes. I want to thank Dr.
14 Hannaforð for his comments, too.

15 I wanted to comment on his comment about
16 the robots that do the car welds. In those
17 situations, it is a significantly different
18 situation because I think the car is in the same
19 spot each time and the car is the same size each
20 time, and the robot knows exactly where it is going
21 to go each time.

22 In a surgical thing with a robot, and I

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1 have only done this once with H.A.P. Paul about ten
2 years ago, the cutting location for the robot is
3 determined by the surgeon, pre-op, and there can't
4 be any screw-ups with the software or the surgeon
5 doing that.

6 The cutting location is determined by
7 the surgeon in registration at the time of surgery
8 so that the robot knows where the bone is. The
9 bone location is determined by the surgeon, and
10 hopefully not moved during the cutting process.

11 So, there are multiple potential areas
12 for problems to occur where there shouldn't be any
13 problems that occur.

14 I think these are the issues that make
15 it different from an industrial robot.

16 While I say that, I don't want anybody
17 to think I am against robots. I think that it is
18 something that is going to come and it will be very
19 helpful to surgery in general, and probably
20 orthopedics in particular. I don't know when,
21 though.

22 DR. YASZEMSKI: Thank you, Dr. Skinner.

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1 Dr. Laurencin?

2 DR. LAURENCIN: I'll just close in that
3 traditionally orthopedic surgeons have always
4 embraced new technology. Ninety per cent of the
5 operations that we do involve new technology.

6 If you look at surgery such as
7 arthroscopy, thirty years ago it really didn't
8 exist. Total joint replacements. Everything in
9 our generation, a generation ago, really didn't
10 exist.

11 So, we traditionally embrace new
12 technology.

13 One of the issues that comes up, in
14 terms of this group, is what sort of endpoints we
15 should be looking at short-term and long-term to
16 determine whether this new technology will be
17 viable or not.

18 My feeling is that it may take, at least
19 for the first new materials coming through, an
20 over-evaluation in terms of endpoints just to make
21 sure that all bases are covered.

22 For instance, if we are looking at a

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1 total joint replacement we may have to look at the
2 endpoints that we traditionally look for even in a
3 new device for total joint replacements.

4 You may say that this is very different
5 from a new device. But in many ways, the types of
6 procedures that are done in terms of some of the
7 more advanced procedures that are done with
8 robotics are actually are creating a new way that a
9 prosthesis may function.

10 So, we have to consider, in terms of
11 what our endpoints are, we have to start by I think
12 looking at the endpoints that we traditionally use
13 for total joint replacements and then say are these
14 appropriate endpoints for this sort of situation.

15 Understanding that in the first couple
16 of ones that go through, we may be looking with a
17 fine-toothed comb. But that over time, when more
18 are accepted, we will have a basis for moving down
19 from there.

20 DR. YASZEMSKI: Thank you, Dr.
21 Laurencin.

22 DR. HANNAFORD: Mr. Chairman, could I

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1 just briefly respond to Dr. Skinner?

2 DR. YASZEMSKI: Dr. Hannaford.

3 DR. HANNAFORD: Thank you. Yes, Blake
4 Hanford.

5 I very much agree with your comment.
6 So, I just want to clarify that all my praise of
7 industrial robots was not meant to say that they
8 are automatically safe in this kind of context, by
9 any means.

10 I was really referring to the robot arm
11 as a component in this kind of system.

12 So, my remarks about the fact that these
13 control systems are modified and expanded into
14 bigger systems, address your concern.

15 So, I thank you for clarifying that.

16 DR. YASZEMSKI: Thank you, Dr.
17 Hannaford.

18 At this point I would like to give a
19 short summary of the discussion from Mr. Dillard
20 and the FDA, then proceed to ask whether we've
21 answered the questions they posed to us.

22 With respect to the first question, the

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1 issues and engineering concerns, the panel felt
2 that a main issue was does the equipment meet its
3 performance specifications.

4 That is, if the issue is to cut a hole
5 or cut a surface, then we would suggest to the FDA
6 that the necessary data, from an engineering
7 perspective, is did the equipment do that and do
8 that safely.

9 Safety issues came up repeatedly through
10 the discussion. The general feeling was that
11 accuracy and predictability of the cut is paramount
12 and that safety should be the number one issue.

13 So, if blind positioning, especially of
14 the effector occurs, then there must be some sort
15 of registration, be it determined by the surgeon
16 directly by anatomic means or by some surrogate
17 means, to be sure that the effector tip is where it
18 should be prior to beginning its cut.

19 With respect to question number two,
20 clinical study endpoints, we heard from Dr. Larntz
21 that we should use the same type of controlled
22 studies that we would use to evaluate total joint

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1 arthroplasty, in either the short or the long term,
2 without the robot.

3 And really try not to deviate from that,
4 and to be certain that we don't make the statement
5 that we have a new tool and all we have to look at
6 is the tool.

7 Dr. Laurencin reminded us that we have
8 well established clinical endpoints for total joint
9 arthroplasty outcomes that we have used over a
10 variety of generations of equipment, and that
11 perhaps we should continue to use those that are
12 tried and true.

13 I think those would be our thoughts for
14 both questions two and question four.

15 With regard to question three, Dr.
16 Skinner made the comment that the day after surgery
17 should be the time from short-term to assess
18 whether if any sentinel events occurred, perhaps
19 new complications that don't currently occur with
20 surgeons who are doing this manually.

21 We should look in the short-term for new
22 things, specifically large complication type

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1 things.

2 I think this summarizes our thoughts on
3 this and would ask Mr. Dillard if we have answered
4 these questions to the FDA's satisfaction.

5 MR. DILLARD: Jim Dillard.

6 Thank you, Dr. Yaszemski.

7 I might have one follow-on that perhaps
8 ties a couple of these together. I appreciate
9 everyone's comments because I think they will be
10 very helpful.

11 One of the things that perhaps we are
12 struggling with the most, and I think you were
13 pretty clear in some of your comments about
14 clinical endpoints and utilizing the clinical
15 endpoints, certainly in the early term with these
16 types of technologies, and that will be very
17 important.

18 One of the questions that we get
19 repeatedly in this area is, as I would term it,
20 perhaps, a tool approach versus the clinical
21 outcome approach.

22 I think that many companies in this area

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1 are quite concerned about being judged to a
2 standard that might be a higher or at least as high
3 as a standard for the new particular implants that
4 we have, that Dr. Laurencin talked about, versus
5 what their product is specifically intended to do,
6 which is to be a tool that cuts, shapes, mills,
7 reams, et cetera.

8 One of the greatest struggles I think we
9 have is the issue between surrogate and clinical
10 endpoints.

11 I just was curious whether or not
12 anybody had any comments about how to tie those two
13 together, and if there were any circumstances where
14 one might see that surrogate endpoints might be
15 adequate enough, or under all circumstances would
16 this panel recommend that clinical endpoints is
17 where the focus ought to be, from the standpoint of
18 the FDA?

19 DR. YASZEMSKI: Thank you, Mr. Dillard.

20 Mr. Dillard, before I open that to the
21 panel, may I ask for a clarification?

22 Have there been any suggested surrogates

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1 to the FDA that we might consider specifically at
2 this point?

3 MR. DILLARD: At the risk of not being
4 able to disclose too much information with the
5 companies that may have products under review, I
6 think the concept might be when Dr. Skinner was
7 talking about the accuracy with which cuts can be
8 made, and the ability to be able to determine how
9 accurate and reproducible those cuts might be, then
10 is it adequate enough to look, in the short-term
11 , at the performance of those cuts and whether
12 or not we have good short-term outcomes, based on
13 what the product is intended to do, versus an
14 effect on the long-term outcomes and clinical
15 performance when you actually the place the implant
16 and you look then at the surgery plus the implant
17 and what the effects may be.

18 How do you tease those out? The effects
19 due to the tool and the effects due to the implant.

20 DR. YASZEMSKI: Thank you, Mr. Dillard.

21 I would like to open that up to the
22 panel.

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1 Dr. Aboulafia?

2 DR. ABOULAFIA: I can't give you an
3 example about a specific product for reasons of
4 protecting industry, but I think it depends.

5 To use your example though it may not be
6 the best, if you are looking at the accuracy of the
7 cut, and you are making the cut the same way you do
8 all the other times, then it probably isn't
9 important to get any more than 24 hours long-term
10 follow-up.

11 But if you are measuring that cut and
12 then using an instrument other than what you
13 normally use to cut the bone, then maybe it will be
14 a difference.

15 Maybe there is heat generated from the
16 device which is different than standard transverse
17 oscillating saw.

18 Maybe the heat generated from making
19 that cut may have an adverse effect on the fixation
20 to the bone, and in six months you might see
21 mechanical loosening and complications.

22 So, I don't think that you can say,

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1 categorically, that everything is going to be the
2 same. We need long-term follow-up on all of them.

3 I think you do have to tease them up to
4 say is it really just measuring an ankle and
5 everything else is the same or are we doing
6 something inherently different with this after we
7 do that.

8 DR. YASZEMSKI: Thank you, Dr.
9 Aboulafia.

10 Dr. Cheng?

11 DR. CHENG: I think I would just mention
12 to the FDA, it depends on what the manufacturer or
13 the sponsor is claiming the device does.

14 If it actually improves the patient
15 outcome, then they have to show that.

16 I have no doubt that a machine can
17 precisely do some mechanical act better than I can
18 do it. There is no question.

19 But the second part to my initial
20 comments, is the result meaningful really begs a
21 question.

22 Is it useful in surgery, number one?

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1 How is it useful? Does it make the
2 patient's outcome better in some way? Does it make
3 the ability of the surgeon to implant something or
4 do some particular task better?

5 So, your questions are a little bit
6 vague and hard to answer because they aren't
7 specific enough.

8 But in general, I guess we would go back
9 to what the sponsors are claiming the device will
10 do.

11 DR. YASZEMSKI: Thank you, Dr. Cheng.

12 Other comments? Dr. Besser?

13 DR. BESSER: I guess a question to the
14 FDA.

15 When a company brings an orthopedic
16 implant to the FDA for approval, usually along with
17 that system is instrumentation for making the cuts
18 that are required to implant that.

19 How are those instruments currently
20 evaluated? Are they evaluated separately from the
21 device or merely as a clinical endpoint after you
22 have the whole device in?

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1 DR. YASZEMSKI: Mr. Dillard?

2 MR. DILLARD: Thank you.

3 I would say that perhaps there are two
4 different circumstances.

5 One would be dedicated surgical
6 instruments that come as part of the kit with the
7 implant or as a stand-alone basket of tools that go
8 along with a line of implants.

9 Many times those particular tools are
10 not looked at. Manual surgical instruments, for
11 example which is a category of products, that you
12 can find in our code of federal regulations, are
13 currently exempt products from pre-market
14 notification.

15 If there are special kinds of manual
16 surgical instruments or special kinds of orthopedic
17 surgical instruments, that are very specific to a
18 type of procedure, for example, which come with a
19 new indication for use or a very new kind of
20 technology, many times we will evaluate those at
21 the same time that we are evaluating the new type
22 of technology.

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1 So, I think, as the statement goes,
2 there is not an easy answer.

3 There is probably the spectrum here of
4 those products which are very much like manual
5 surgical instruments, other orthopedic instruments
6 that are commonly used across many procedures that
7 would be exempt from pre-market review, to those
8 that are very specialized, may come with their own
9 intended use, and are for a specific new type of
10 technology that would be evaluated with that
11 technology.

12 DR. BESSER: Dr. Besser. If I may
13 follow-up.

14 Then for that second category, where it
15 comes for a very specific use such as for an
16 orthopedic implant, are there surrogate endpoints
17 that you look at for that positioning jig or
18 cutting device, or are the only endpoints that you
19 are looking at the clinical endpoints, long-term,
20 was this successful surgery?

21 DR. YASZEMSKI: Mr. Dillard.

22 MR. DILLARD: I think in that kind of

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1 situation, many times if it is a new implant that
2 needs clinical study, for the new implant we will
3 also look at the type of human factors, we will
4 look at evaluation of the types of tools that go
5 along with the implant.

6 We tend to take more of a procedural
7 look. Is the procedure, which includes the
8 physician, the implant tools, as well as the new
9 implant, what is the overall success of the total
10 procedure?

11 We tend to label it from that particular
12 vantage point.

13 That isn't to say though, that there
14 aren't specific tools that are manufactured to do a
15 procedure that don't include a prosthesis, for
16 example, that might not have their own evaluation.

17 Sometimes, they do if it is a new type
18 of tool.

19 Many times, if the questions are in the
20 short-term and what the effect is, we tend to focus
21 on those issues that need to be answered for that
22 particular type of tool.

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1 So, I think we have tried to take the
2 approach of what are the appropriate questions and
3 issues that need to be addressed for that
4 particular type of situation, and tried to focus
5 our attention on that.

6 So, I am echoing a little bit of the
7 vagueness of my answer to Dr. Cheng, to try to get
8 you all to address both of those kinds of
9 situations, in this particular case.

10 DR. YASZEMSKI: Thank you, Mr. Dillard.

11 Dr. Besser?

12 DR. BESSER: Then, I would say, in
13 response to the FDA question that, yes, it depends
14 on what we are looking at.

15 If you have a device whose specific task
16 is to cut a line at this angle, then I would say
17 your first surrogate endpoint is absolutely, did it
18 cut that line at that angle?

19 But then you can't do the operation was
20 a success; the patient died kind of thing where you
21 also want to look at the clinical endpoint. Now
22 that it has cut that line at that angle, did that

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1 help?

2 DR. YASZEMSKI: Thank you, Dr. Besser.

3 Dr. Skinner?

4 DR. SKINNER: I want to comment on Dr.
5 Aboulafia's comment which I think was very
6 worthwhile and very important.

7 Such things as thermal damage could
8 cause a change in the bone in a femoral canal, for
9 instance, over a period of time.

10 I think though, that it would be more
11 likely, since the prosthesis fits the bone
12 perfectly after one of these robots cuts the hole
13 for the prosthesis, that what we are looking at is
14 a situation where the bone and the prosthesis fit
15 together perfectly the day it is put in, and the
16 next day the bone starts remodeling.

17 So, any changes you see six weeks or six
18 months or six years later might be due to the
19 prosthesis and not necessarily the cutting.

20 I think that adds a variable that makes
21 the interpretation much more difficult.

22 I would still lean towards considering

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1 it to be a tool.

2 DR. YASZEMSKI: Thank you, Dr. Skinner.

3 Mr. Dillard, may I submit to you and the
4 FDA that the additional discussion has led us to
5 comment that there is a great deal of uncertainty,
6 at this time, to your question, and that it appears
7 that surrogate endpoints seem to be appropriate,
8 but we would like to suggest to the FDA to reserve
9 caution.

10 To not rely only upon them, but also
11 give consideration to other long-term changes that
12 may arise as a result of this new technology.

13 Have we adequately answered the FDA's
14 questions at this point?

15 MR. DILLARD: Yes, I think you have
16 provided us with good guidance, and I appreciate
17 the discussion.

18 DR. YASZEMSKI: Thank you, very much,
19 Mr. Dillard.

20 We will now proceed to the closed
21 session.

22 I would ask that we clear the room

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1 because the remainder of this meeting is closed to
2 the public.

3 We will take a five minute break while
4 the room is being cleared, and only previously
5 designated individuals, who have proper
6 identification, will be permitted to stay for the
7 closed session, scheduled to discuss a clinical
8 study.

9 Thank you, very much.

10 (Whereupon, the proceedings went off the
11 record and then resumed in Closed Session.)

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