Class II Special Controls Guidance Document: Root-form Endosseous Dental Implants and Abutments; Draft Guidance for Industry and FDA

Draft Guidance – Not for Implementation

This guidance document is being distributed for comment purposes only.
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When final this document will supersede:

- Overview of Information Necessary for Premarket Notification Submissions for Endosseous Implants; Final, 04/21/1999
- Information Necessary for Premarket Notification Submissions For Screw-Type Endosseous Implants, 12/09/1996
- Guidance For the Arrangement and Content of a Premarket Approval (PMA) Application for An Endosseous Implant For Prosthetic Attachment, 5/16/89
- (parts of) Calcium Phosphate(Ca-P) Coating Draft Guidance for Preparation of FDA Submissions for Orthopedic and Dental Endosseous Implants, 2/21/97

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Preface

Public Comment

For 90 days following the date of publication in the Federal Register of the notice announcing the availability of this guidance, comments and suggestions regarding this document should be submitted to the Docket No. assigned to that notice, Dockets Management Branch, Division of Management Systems and Policy, Office of Human Resources and Management Services, Food and Drug Administration, 5630 Fishers Lane, Room 1061, (HFA-305), Rockville, MD 20852.

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This document is intended to provide guidance. It represents the Agency's current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind the Food and Drug Administration (FDA) or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute and regulations.

1. Background

This guidance document was developed as a special control guidance to support the reclassification of the root-form endosseous dental implant device into class II and the reclassification of the endosseous dental implant abutment device into class II. The root-form endosseous dental implant device refers to the endosseous dental implant fixture. It is intended to be surgically placed in the bone of the upper or lower jaws to provide support for prosthetic devices, such as artificial teeth, in order to restore the patient's chewing function. The endosseous dental implant abutment device is intended to be used with the dental implant fixture to aid in prosthetic rehabilitation. Some endosseous dental implants may include an integral transgingival component. These implants do not require the concurrent use of a dental implant abutment.

FDA will issue this guidance in conjunction with a Federal Register notice announcing the proposal to reclassify these devices. This guidance is for comment purposes only. If the final rule does not reclassify these devices, this guidance document will not be issued as a special control.

FDA believes that these special controls, when combined with the general controls, will be sufficient to provide reasonable assurance of the safety and effectiveness of the root-form endosseous dental implant device and the endosseous dental implant abutment device. If these devices are reclassified, a manufacturer who intends to market a device of either generic type must (1) conform with the general controls of the Food, Drug & Cosmetic Act, including the 510(k) requirements described in 21 CFR 807 Subpart E, (2) address the specific risks to health associated with the device described in the special control guidance, and (3) receive a substantial equivalence determination from FDA prior to marketing the device.

This special control guidance document identifies the classification, product code, and classification definition for the root-form endosseous dental implant device and the endosseous dental implant abutment device. In addition, it identifies the risks to health. FDA believes that the controls described in this guidance, when followed and combined with the general controls,

will generally address the risks associated with these generic device types and facilitate 510(k) review and clearance. For the specific content requirements of a 510(k) submission, you should refer to 21 CFR 807.87 and other agency documents on this topic, such as the **510(k) Manual - Premarket Notification: 510(k) - Regulatory Requirements for Medical Devices**, http://www.fda.gov/cdrh/manual/510kprt1.html.

Device manufacturers may submit an Abbreviated 510(k) when: (1) a guidance documents exists, (2) a special control has been established, or (3) FDA has recognized a relevant consensus standard. FDA believes an Abbreviated 510(k) is the least burdensome means of demonstrating substantial equivalence once a Class II Special Controls Guidance Document has been issued. See also **The New 510(k) Paradigm - Alternate Approaches to Demonstrating Substantial Equivalence in Premarket Notifications; Final Guidance**, http://www.fda.gov/cdrh/ode/parad510.html.

An Abbreviated 510(k) submission must include the required elements identified in 21 CFR 807.87, including a description of the device, the intended use of the device, and the proposed labeling for the device. An Abbreviated 510(k) should also include a summary report. In an Abbreviated 510(k), FDA may consider the contents of a summary report to be appropriate supporting data within the meaning of 21 CFR 807.87(f) or (g).

The summary report should briefly describe the methods or tests used and the acceptance criteria applied to address the risks identified in this guidance document as well as any additional risks specific to your device. When a suggested test method is followed, a simple reference to the method will be an acceptable description. If there are any deviations from a suggested test method, you should provide more detailed information in the summary report to characterize the particular deviation. The summary report should also either (1) briefly present the data resulting from each test **or** (2) describe the acceptance criteria to be applied to the test results. (See also 21 CFR 820.30 Subpart C Design Controls for the Quality System Regulation.)

2. Scope

FDA identifies the generic root-form endosseous dental implant device as a Dental Devices Panel device classified under 21 CFR 872.3640, product code DZE. A root-form endosseous dental implant device is intended to be surgically placed in the bone of the upper or lower arches to provide support for prosthetic devices, such as artificial teeth, in order to restore the patient's chewing function.

FDA identifies the generic and the endosseous dental implant abutment device as a Dental Devices Panel device classified under 21 CFR 872.3640, product code NHA. An endosseous dental implant abutment device is intended to be used in conjunction with an endosseous dental implant fixture to aid in prosthetic rehabilitation.

3. Risks to Health

FDA has identified the risks to health generally associated with the use of the root-form endosseous dental implant device in the table below. You should also conduct a risk analysis, before submitting your 510(k), to identify any other risks specific to your device. The premarket notification should describe the risk analysis method. The measures recommended to mitigate the identified risks are given in this guidance document, as shown in the table below. (If a manufacturer elects to use an alternative approach to address a particular risk, or has identified risks additional to those in the guidance, you should provide sufficient detail to support the alternative approach.)

Identified risk	Recommended mitigation measures
local soft tissue degeneration	9,11
hyperplasia	11,12
progressive bone resorption	9,11
exfoliation	9,11
damage to existing dentition	7,9
implant mobility	7,9,11
infection	11,12
paresthesia	12,15
perforation of the maxillary sinus	12,15
perforation of the labial and lingual alveolar plates	12,15
bacterial endocarditis	11,12
loss of implant integrity	7,9,11

The risks to health that are generally associated with the use of endosseous dental implant abutment devices are listed in the table below.

Identified risk	Recommended mitigation measures
local soft tissue degeneration	9,11
damage to existing dentition	7,9
loss of abutment integrity	7,8,12

4. Controls

FDA believes that the controls in the following sections of this guidance, when combined with

general controls, will address the identified risks to health associated with the use of the root-form endosseous dental implant device and the endosseous dental implant abutment devices.

You should demonstrate that your device complies with either the specific recommendations of this guidance or an alternate means to address the above identified risks, in order to provide reasonable assurance of the safety and effectiveness of the device. If you have identified any additional risks, specific to your device, your 510(k) should identify those risks, as well as the methods or tests used and the acceptance criteria applied to address them.

5. Abbreviated 510(k) Content

An Abbreviated 510(k) that relies on a Class II Special Controls Guidance Document should contain the following.

Coversheet

The coversheet should prominently identify the submission as an Abbreviated 510(k) and cite the title of the specific Class II Special Controls Guidance Document.

Items Required Under 21 CFR 807.87

The items required under 21 CFR 807.87 are:

- Description of the device

  You should include a compete discussion of the performance specifications and, when appropriate, detailed, labeled drawings of the device. You should also include a description of device features, with dimensions and tolerances. Examples of features include anti-rotational features, such as internal or external hexagonal features, flat axial surface features on fixtures, fins, threads, or vertical anti-rotation slots.

- Engineering drawings of all components

  You should include drawings showing all dimensions and tolerances. All drawing labels should be clearly legible and in English.

- Intended use of the device

  You should include a description of compatible abutments, including surfaces that mate with implant fixtures. List or give examples of compatible fixture types made by other manufacturers. You should also submit an "indications for use" enclosure. See http://www.fda.gov/cdrh/ode/indicate.html for the recommended format.

- Proposed labeling

Summary Report

A summary report should describe how the Class II Special Controls Guidance Document was used to address the risks associated with the particular device type. In an Abbreviated 510(k), FDA may consider the contents of a summary report to be appropriate supporting data within the meaning of 21 CFR 807.87(f) or (g). The summary report should contain:

- Risk analysis
- Description of device performance requirements
- Discussion of the features and functions provided to address the risks identified in this Class II Special Controls Guidance Document, as well as any additional risks identified in your risk analysis.
- For each performance aspect identified in sections 6 through 10 of this Class II Special Controls Guidance document, you should briefly discuss each test method and your acceptance criteria. When a suggested test method is followed, a simple reference to the method will be an acceptable description. If there are any deviations from a suggested test method, you should provide more detailed information in the summary report to characterize the particular deviation. The summary report should also either (1) briefly present the data resulting from each test in tabular form **or** (2) describe the acceptance criteria to be applied to the test results. If the device, as manufactured, does not meet your acceptance criteria, you may not market it. Instead, you must submit a new 510(k) with revised acceptance criteria which must be cleared by FDA before you market the device.
- If any part of the device design or testing relies on a recognized standard, the summary report should include: (1) a statement that testing will be conducted and meet specified acceptance criteria before the product is marketed, or (2) a declaration of conformity to the standard. Testing must be completed before submitting a declaration of conformity to a recognized standard. (21 USC 514(c)(2)(B)). For more information, see FDA guidance, **Use of Standards in Substantial Equivalence Determinations; Final Guidance for Industry and FDA**, http://www.fda.gov/cdrh/ode/guidance/1131.html.
- If FDA recommends a clinical study for your device (see section 12), your summary report should state that you followed the clinical protocol described in section 13. If you have deviated from this protocol, you should describe the deviations and explain how your protocol addressed the risks. Your summary report should include the information described in section 14. If you have omitted any of the information described in section 14, you should explain how substantial equivalence can be determined without this information.

If it is not clear how you have addressed the risks identified by FDA or by your risk analysis, we may request additional information about aspects of the device's performance characteristics.

We may also request additional information, if we need it to assess the adequacy of your acceptance criteria.

As an alternative to submitting an Abbreviated 510(k), you can submit a traditional 510(k) that provides all of the information and data described in this guidance. A traditional 510(k) should include all of your methods, data, acceptance criteria, and conclusions.

For all testing, your summary report should include:

- standard deviation analysis
- reference to the test method or summary of your test protocol
- methods for sample preparation
- drawing of your test set up
- failure report
- magnified photographs of the failure regions
- acceptance criteria for each test, unless specification included in the recognized standard

You may use the FDA guidance documents and recognized consensus standards listed below to establish the performance characteristics of your device.

FDA Guidance Documents

- 510(k) Sterility Review Guidance 2/12/90 (K90-1) http://www.fda.gov/cdrh/k90-1.html

- Use of International Standard ISO-10993, Biological Evaluation of Medical Devices Part 1: Evaluation and Testing http://www.fda.gov/cdrh/g951.html

Consensus Standards

- ASTM F67-95 Standard Specifications for Unalloyed Titanium for Surgical Implant Applications

- ASTM F86-91 Standard Practice for Surface Preparation and Marking of Metallic Surgical Implants

- ASTM F136-98e1 Standard Specification for Wrought Titanium-6 Aluminum-4 Vanadium ELI (Extra Low Interstitial) Alloy (R56401) for Surgical Implant Applications

- ASTM F561-97 Practice for Retrieval and Analysis of Implanted Medical Devices, and Associated Tissues

- ASTM F601-98 Standard Practice for Fluorescent Penetrant Inspection of Metallic Surgical Implants
- ASTM F620-97 Standard Specification for Titanium-6 Aluminum-4 Vanadium ELI Alloy Forgings for Surgical Implants (UNS R56401)
- ASTM F746-87(1994) Standard Test Method for Pitting or Crevice Corrosion of Metallic Surgical Implant Materials
- ASTM F1044-95 Standard Test Method for Shear Testing of Porous Metal Coatings
- ASTM F1108-97 Standard Specification for Titanium-6 Aluminum-4 Vanadium Alloy Castings for Surgical Implants (UNS R56406)
- ASTM F1147-99 Standard Test method for Tension Testing of Calcium Phosphate and Metal Coatings
- ASTM F1160-98 Standard Test Method for Shear and Bending Fatigue Testing of Calcium Phosphate and Metallic Medical Coatings
- ASTM F1185-88 (1993)e1 Standard Specification for Composition of Ceramic Hydroxylapatite for Surgical Implants
- ASTM F1472-93 Standard Specification for Wrought Ti-6Al-4V Alloy for Surgical Implant Applications
- ASTM F1501-95 Standard Test Method for Tension Testing of Calcium Phosphate Coatings
- ASTM F1580-95 Standard Specification for Titanium and Titanium-6% Aluminum-4% Vanadium Alloy Powders for Coating Surgical Implants
- ASTM F1609-95 Standard Specification for Calcium Phosphate Coatings for Implantable Materials
- ASTM F1658-95 Standard Test Method for Shear Testing of Calcium Phosphate
- ASTM F1659-95 Standard Test Method for Bending and Shear Testing of Calcium Phosphate Coatings on Solid Metallic Substrates
- ASTM F1801-97 Standard Practice for Corrosion Fatigue Testing of Metallic Implant Materials
- ISO 5832-2:1993 Implants for Surgery - Metallic Materials - Part 2: Unalloyed Titanium

- ISO 5832-3:1996 Implants for Surgery - Metallic Materials - Part 3: Wrought Titanium 6-Aluminum 4-Vanadium Alloy

- ISO 7405:1997 Dentistry - Preclinical Evaluation of Biocompatibility of Medical Devices Used in Dentistry - Test Methods for Dental Materials

6. Material Composition

Your summary report should include the following information for all components:

- the material identity

- the complete chemical composition, unless declaring conformance to a materials standard

7. Mechanical Properties

Your summary report should include the following information for the finished device:

- a description of mechanical properties

- the methodology for determining the mechanical properties, if a testing standard was not used.

8. Fixture To Abutment Compatibility

You should describe the performance testing conducted to determine fixture-to-abutment compatibility.

9. Fatigue Testing in Compression and Shear

You should conduct mechanical testing for devices that:

- consist of angled abutments;

- are implant or abutment designs that are significantly different from predicate devices; or

- have design features or technological characteristics that have not been previously cleared for market.

You should test the finished device or components that have undergone the same manufacturing processes as a finished device. You should explain how the properties of the new device show adequate device performance.

Some implants do not use a separate abutment component. However, for those that do, you should test the assembled implant/abutment system. If the implant or abutment is marketed by another manufacturer, you should follow the assembly instructions that manufacturer provides.

You should set up testing to ensure that the implant or implant/abutment system is subjected to both compressive and shear (lateral) forces. No lateral constraint should occur. Testing conditions should mimic actual intraoral use as much as possible.

You should perform testing of angled abutments at the greatest angulation intended (i.e., the worst case scenario). Abutment angulation greater than 30° should be supported by clinical data. The test setup should clamp the implant so that the implant's long axis makes a 30° angle with the loading direction of the testing machine, unless you are testing an angled abutment of greater than 20°. For angled abutments, the test setup should leave at least 10° of the angulation uncorrected (i.e., a 30° abutment should be tested with the implants long axis at 40° and a 25° abutment should be tested with the implants long axis at 35°). The implant should be supported 3mm below the anticipated crestal bone level, simulating 3mm of bone resorption.

You should perform fatigue testing in a simulated physiological solution at 37°C, at 2 Hz frequency. You should determine the maximum load (endurance limit) your device can withstand for 2×10^6 cycles without failure. Alternatively, if the materials used are not subject to corrosion fatigue and there are no plastic components, you may perform the test in air at 20°C, at 3-15Hz frequency for 5×10^6 cycles.

You should begin testing at a load above the static failure load of your device system (this load should be determined using a test setup like that used for the fatigue testing, but without the cyclic loading) and decrease the load until the endurance limit is reached. You should test three specimens to failure at each load, including the endurance limit. You should test a minimum of 4 loads for a total of 12 specimens.

You should identify the critical failure point and the location of failure initiation on the device component that fails. Failure is defined as material yielding, deformation, or fracture. You should compare testing results observed for the claimed predicate device(s). You should include a graph of the load versus number of cycles curve along with testing results and data presented in tabular form.

An alternate approach to the load versus number of cycles curve is acceptable. This may allow the use of fewer samples. One approach is to select a load that is 10% below the static failure load of the device system. Test at least 5 samples at the selected load. All samples should withstand 5 million cycles. If any samples fail, you should test 5 additional samples at a slightly lower load. Using this alternate approach, testing should be performed in a simulated physiological solution as described above unless the materials are not subject to corrosion fatigue and there are no plastic components.

10. Corrosion Testing

You should conduct corrosion testing when the implant system includes components fabricated from dissimilar metals. You should perform this testing in a simulated physiological solution at 37°C. Passivated (i.e., finished device condition) and nonpassivated metal surfaces should be evaluated. This testing should assess:

- corrosion potential of each metal or alloy;
- couple potential for the assembled dissimilar metal implant system; and
- corrosion rate for the assembled dissimilar metal implant system.

11. Modified Surfaces Information

You should describe the implant surface characteristics, if the surface is modified or has properties claimed to facilitate bone deposition. You should include information on the nature of, and processes by which surfaces are modified such as coatings, blasted surfaces, etched surfaces, or other surface treatments that are applied.

Ceramic Coating Information

Your summary report should include the information listed below for an implant coated with a ceramic coating such as hydroxyapatite or calcium phosphate.

- particle size and particle size distribution of the powder used for the coating
- average porosity size
- overall pore volume
- identity of the area of the implant to be coated
- scanning electron microscopy pictures at 100X of the coated implant surfaces and of a cross-sectioned area of the device showing the coating interface
- measurements of coating thickness and tolerances
- chemical analysis of the powder before and after coating, including Ca/P ratios in atomic percent and elemental analysis
- total percentage of all crystalline phases in the coating and total percentage of crystalline hydroxyapatite in the coating
- static tensile and shear bonding strengths between the coating and the implant surface with testing from at least 5 samples included in the averages
- type of deposition process used and the post-deposition treatment

- x-ray diffraction pattern of the powder and the coating in terms of relative intensity versus diffraction angle
- surface roughness of the coating
- abrasion characteristics of the coating, including the abrasion testing methodology.

Metallic Coating Information

Your summary report should include the information listed below for an implant coated with a metallic coating:

- complete chemical composition of the coating
- coating thickness and porosity
- mean volume percent of voids
- surface roughness of the coating
- identity of the area of the implant to be coated
- scanning electron microscopy pictures at 100X of the coated implant surfaces and of a cross-sectioned area of the device showing the coating interface
- static tensile and shear bonding strengths of the coating to the implant with results from at least 5 samples included in the averages
- abrasion characteristics of the coating, including the abrasion testing methodology.

Blasted Surfaces Information

Your summary report should include the information listed below for an implant with a blasted surface:

- identity of any surface treatments that blast the implant
- composition of the particles
- identity of any treatments to remove particles from implant fixture surfaces
- identity of agents used in particle removal
- chemical analysis of the surface to verify that any chemicals used to remove particles have been washed from the surface
- photomicrographs of blasted surfaces to show whether or not there are particles remaining behind on the surface.

12. Animal and Clinical Studies

FDA recommends animal and/or clinical studies for dental implants with the following features:

- designs dissimilar from designs previously cleared under a 510(k)
- lengths less than 7 mm and/or fixture diameters less than 3.25 mm
- an angulation of the accompanying or recommended fixture abutment greater than 30°

If you believe clinical studies are not warranted, you should submit a justification. FDA will evaluate this justification on its scientific merit.

Clinical investigation ordinarily should include a randomized, well-controlled clinical trial designed to demonstrate the substantial equivalence of the device when used as described in the Indications for Use statement. For statistical purposes, the study should demonstrate the device is substantially equivalent to, or not inferior to the performance of devices with established designs. Each study arm should have a statistically valid number of patients. Consultation with a statistician familiar with medical device research statistics is highly recommended.

You should conduct clinical evaluation of implants and abutments for a minimum of three years with the implant under loaded conditions. Data to be evaluated should include such information as implant mobility, infections, broken fixtures or abutments, adverse events, and include a detailed explanation for all patients lost to follow-up. Data derived from these investigations should meet the definition of valid scientific data as defined in 21 CFR 860.7. The studies should be conducted by qualified investigators experienced in implant dentistry, clinical research design, and data analysis.

If a clinical study is needed to demonstrate substantial equivalence, i.e., conducted prior to obtaining 510(k) clearance of the device, the study must be conducted under the IDE regulation (21 CFR 812). FDA has determined this device is a significant risk device as defined in 21 CFR 812.3(m)(4) and, therefore, studies involving these devices do not qualify for the abbreviated IDE requirements of 21 CFR 812.2(b). In addition to the requirement of having an FDA-approved IDE, sponsors of such trials must comply with the regulations governing institutional review boards (21 CFR 56) and informed consent (21 CFR 50).

13. Clinical Protocol

Study Population and Inclusion Criteria

You should clearly define the inclusion/exclusion criteria. You should describe and justify any deviations from your inclusion/exclusion criteria. You should describe the study population in terms of the distribution of the variables, if relevant to study outcome, listed below:

- intended use of the device
- number of patients in experimental and control groups

- age and gender distribution of the patients in the experimental and control groups
- status of dentition (dentate vs. edentulous, minimum number of teeth and maxillomandibular jaw relationships)
- occlusal scheme (i.e., cross bites, tilted teeth, teeth in buccoversion/labioversion)
- minimal ridge dimensions and quality of bone (Type I-IV[1]), if part of the protocol
- applicable prosthetic variables, such as restorative materials, permissible abutment angulation, and length of span for implant supported bridges.

Pre-implantation Assessment

The pre-implant assessment described in your study protocol should include the following information:

- description of the general health of the patient, identifying any medical conditions that may affect the outcome of the study
- description of the patient's dental status that may affect the outcome of the study
- location of the intended site(s) for implantation
- description of special conditions for which the implant is to be used (e.g., Type IV bone, for maxillary sinus areas), pathological conditions (e.g., infection, bleeding, inflammation), and the condition of the opposing teeth and type of occlusion
- identification of patients who brux or clench
- standardized radiographs to quantify the ridge height and width of the supporting bone and locate major anatomical features. These radiographs should be standardized so that each subsequent radiograph can be directly compared to the original preoperative radiographs. You should also use this procedure in the post-implant assessments. Examples of appropriate radiographs are listed below:
    - periapical or panoramic radiographs
    - extraoral radiographs
    - cephalometric radiographs
    - Computed Axial Tomography (CAT) Scans
- oral hygiene regimen to be used around the implant based on labeling claims or instructions
- density of bone at the implant site (i.e., Type I to Type IV bone)

[1] Misch, CE. Contemporary Implant Dentistry. St. Louis, Missouri: Mosby, 1999 pp89-118.

Post-implant Assessment

The post-implant assessment described in your study protocol should include the following information:

- You should define how frequently clinical and radiographic assessment will occur. Postsurgical intervals that have been reported in the dental literature are acceptable. These intervals are weekly for the first month, three months, 6 months, 12 months, 2 years, and 3 years. Minor deviations from this sequence do not raise new questions of safety or effectiveness. Abbreviated evaluation intervals or significant deviations from these parameters should be justified on the basis of wound healing parameters.

- You should specify the time interval between each stage of the implantation (i.e., the time between fixture placement and uncovering for abutment placement and time between fixture placement and occlusal loading). The 3-year follow-up period should be measured from the time the implant is subject to occlusal forces. You should describe the occlusal loading parameters and variations permissible within the protocol.

- You should identify any medications and the amounts taken during the clinical trial that might affect study outcomes. Medications such as antibiotics, analgesics, and topical rinses are examples of medications that you should record. Use of antibiotics, analgesics, and topical rinses should be standardized as much as possible.

- You should obtain radiographs as described in the study protocol. Radiographs may not be required at each post-implant assessment. You should quantify the amount of alveolar ridge resorption based on radiographs. You should also document any radiographic evidence of periapical radiolucency.

- You should record the following clinical parameters and observations during each evaluation.

  Gingival Health

  You should specify the gingival and inflammatory indices used.

  Tooth and Implant Mobility

  You should specify method of evaluation and type of classification used.

  Pocket Probing Depth

  You should use the same type of probe and probing technique at each evaluation. The clinician's technique should be calibrated with respect to force used as well as probe angulation. The use of stents, wherever practical, may improve intra- as well as inter-examiner reliability.

  Clinical Attachment Level

You should use a standardized technique as well as examiner calibration for this measuring the level clinical attachment.

- You should record any postoperative complications encountered, and the times at which they occurred. These include, but are not limited to the post-operative complications listed below:
    - anesthesia or paresthesia, temporary or permanent
    - mandibular fracture
    - significant loss of alveolar ridge height, as specified in the protocol
    - oteomyelitis, oral-antral, or oral-nasal fistula
    - adjacent teeth adversely affected by implant placement
    - abnormal or prolonged pain after insertion as described in protocol
    - infection related to implant placement
    - failure to maintain adequate oral hygiene

14. Clinical Results

Adverse reactions and complications

Your summary report should report each adverse reaction and complication. These include the events listed below:

- infection
- implant loss prior to loading
- implant breakage
- loss of loaded implants
- pain
- altered sensation
- temporomandibular joint problems

Your summary report should provide the number of patients discontinued, the rationale for discontinuation, and the time of discontinuation. Under Adverse Events, you should provide a detailed and complete failure analysis report for each device failure.

Data Tabulation

Your summary report should contain a tabulation of data from all individual subject report forms. You should include copies of subject report forms for each subject who did not complete the investigation, if possible. You should also include a summary table showing the duration of follow-up for each subject in the investigation.

Statistical Analyses

Your summary report should contain the results of statistical analyses of the clinical investigations. These results should include statistical methodology and rationale for each statistical test. You should cite references or submit formulas for each methodology, as well as an explanation of any deviations from the methodology. Analysis of statistical data should show the rate of success, failure, and complications. The time-specific cumulative failure rate and complication rate should be calculated by statistical survival analysis. You should include a lifetable analysis.

Additional Clinical Study Information

You should include articles published in peer reviewed journals, containing information on the device in the 510(k) relevant to the clinical study (i.e., for the same indication, or uses of the implant in a clinical study).

Your clinical study protocol should include a statement regarding study progress at the time you submit your 510(k), stating whether the study is completed, presently in long term follow-up, or enrolling patients. You should also include a statement about how clearance of the 510(k) will change the status of the study.

You should include in the clinical protocol, any methods not previously mentioned, that are used to eliminate bias on the part of the subjects or investigators.

15. Labeling

The premarket notification must include labeling in sufficient detail to satisfy the requirements of 21 CFR 807.87(e).

All root-form endosseous dental implant and endosseous dental implant abutment devices are prescription medical devices. Final labeling for medical devices must comply with the requirements of 21 CFR 801.1 and final labeling for prescription medical devices must comply with 21 CFR 801.109 before being introduced into interstate commerce, however, final labeling is not required for 510(k) clearance. The following information is aimed at assisting manufacturers in complying with 801.109.

Prescription Legend

In accordance with 21 CFR 801.109, root-form endosseous dental implant and endosseous dental implant abutment devices must bear the following caution statement: "Caution: Federal law restricts this device to sale by or on the order of a physician."

Professional Labeling

You provide users with a surgical manual along with the instructions for use. Professional labeling should contain detailed instructions, particularly for those sections of the surgical or restoration procedures where the device differs from other endosseous dental implant systems. You should provide all the precautions and warnings in the professional labeling. If there are any precautions or warnings which relate to unpackaging or sterility, these should be repeated on the package labels.

Sterilization Instructions

If any parts are provided non-sterile that must be sterilized before use, you should provide sterilization instructions.

Patient Labeling

If patient labeling is appropriate, it should be consistent with **Guidance on Medical Device Patient Labeling; Final Guidance for Industry and FDA Reviewers**, http://www.fda.gov/cdrh/ohip/guidance/1128.html.