Chapter 2 – Implant Dentistry Nomenclature, Classification, and Examples

Continuous effort is required to standardize terms used in the discipline of implant dentistry. Currently, terms too often carry different meanings in articles, brochures, and lectures. To facilitate communication it is important to establish a common vocabulary. This chapter reviews and seeks to standardize the vocabulary used in implant dentistry. A glossary at the end of the book is included as an aid.

VOCABULARY

Dental Implant

A dental implant is a device of biocompatible material(s) placed within or against the mandibular or maxillary bone to provide additional or enhanced support for a prosthesis or tooth. Many published definitions of the dental implant include the concept that its purpose is to provide an abutment for restorative dentistry. However, this definition excludes the endodontic stabilizer, an implant that improves the prognosis of a compromised tooth, which then in turn may or may not be used as an abutment under a prosthesis.

Implant Modality

An implant modality, broadly defined, is a generic category of dental implants. Although individual modalities may overlap in application, each modality is distinct from the others in its scope of treatment, diagnostic criteria, possible mode or modes of tissue integration, anatomic requirements, and success and survival rates. Much confusion has resulted from not understanding that the rules, expectations, parameters, and even the philosophies of the use of one modality have little to do with those of another.

Implant System

Different commercial systems are available for most modalities. A system is a specific line of implants. Different root form systems, for example, are produced by Nobel Biocare/Steri-Oss, Innova, Friadent, and a wide range of other manufacturers. Each of these systems is of the same broad category, the root form modality. A single manufacturer often offers several lines of implants, and each line is considered a different system. Thus, a manufacturer may offer a threaded cylinder system and a press-fit system, and each may be available tapered or parallel-sided, coated or uncoated.

Implant Configuration

Various implant configurations usually are found within each system. An implant configuration is a specific shape or size of implant. A wide array of configurations is available to accommodate the anatomic variations of available bone commonly observed in candidate patients for implant treatment.

MODALITIES, SYSTEMS, AND CONFIGURATIONS USED IN THIS BOOK

The professionally accepted implant modalities with mainstream applications covered in this book are listed in Box 2-1. Each of these modalities meets the scientific and clinical criteria for
professional acceptance that are delineated in Chapter 7. These modalities are root forms (Fig. 2-1), plate/blade forms (Fig. 2-2), subperiosteals (Fig. 2-3), endodontic stabilizers (Fig. 2-4), and intramucosal inserts (Fig. 2-5). Modalities that are not covered in this book may not lend themselves to mainstream applications because of clinical considerations such as excessive technique-sensitivity, need for treatment in a hospital environment, or insufficient data to demonstrate high long-term survival rates.

Box 2-1

<table>
<thead>
<tr>
<th>PROFESSIONALLY ACCEPTED IMPLANT MODALITIES WITH MAINSTREAM APPLICATIONS</th>
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<tbody>
<tr>
<td><strong>Endosteal</strong></td>
</tr>
<tr>
<td>Root forms</td>
</tr>
<tr>
<td>Plate/blade forms</td>
</tr>
<tr>
<td>Endodontic stabilizers</td>
</tr>
<tr>
<td><strong>Subperiosteal</strong></td>
</tr>
<tr>
<td>Unilateral subperiosteal implants</td>
</tr>
<tr>
<td><strong>Denture-enhancing</strong></td>
</tr>
<tr>
<td><strong>Intramucosal inserts</strong></td>
</tr>
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Figure 2-1 Root forms used in teaching cases in this book

Figure 2-2 Plate/blade forms used in teaching case in this book.
Figure 2-2 Plate/blade forms used in teaching case in this book

Figure 2-3 Unilateral subperiosteal implant of the type used in teaching case in this book.

Figure 2-4 Endodontic stabilizer used in teaching case in this book.
Rather than attempt to delineate the particularities of each implant system on the market—there are product differences both minor and major in every implant system—we have selected our “systems of choice” to represent mainstream treatment within each modality. We have done this for several reasons. First, to take the particularities of each available implant system into account when describing the step-by-step surgical and restorative procedures would cause the learning curve to be impossibly steep and would make this book prohibitively long. Another all-inclusive approach would have been to genericize any reference to an implant modality, but we rejected this “lowest common denominator approach” because it disallows discussion of the unique benefits of any one system. In a way, taking the generic approach would skirt an issue that we feel responsible to address directly: to specifically identify excellent implant systems that can be used to predictably achieve good results for the mainstream applications identified in this book.

We believe that this is the most informative and helpful approach. We have chosen the systems in this book because we know them to be safe, effective, and technique-permissive in their mainstream applications. Just as importantly, the systems described in this book were chosen because they expand the mainstream applicability of the modalities they represent, either because they are more technique-permissive than other available systems, or because they can fit a wider range of available bone. These are the systems that we recommend to our patients. Keep in mind that when we discuss step-by-step procedures, we are referring to the specific
implant system utilized in that particular teaching case. Many of the features described for one system are applicable to other systems within the same modality, but some are unique to the system being discussed. If one chooses to use a different system within the same modality, one should become familiar with the similarities and differences between the system chosen and the one shown in this book. Do not assume that the features we discuss for one system apply to other systems. For example, the plate/blade system we use is fabricated by 

coining, which alters the metallographic structure to allow the practitioner a greater margin of safety when bending for parallelism or to follow anatomic contours of available bone\textsuperscript{1} (Fig. 2-6). Other plate/blade form systems that are not coined tend to be more brittle and therefore allow for less bending. Another example is the root form system chosen for the partial posterior edentulism teaching case restored with individual crowns. Because of the increased surface area and retention of the system’s diffusion-bonded \textit{microsphere} interface with interconnecting porosities, its shallower implants can function as effectively as deeper conventional threaded root forms\textsuperscript{2} (Fig. 2-7). This substantially expands one’s scope of mainstream treatment, because these implants can be used in a wider range of unaugmented available bone, and can be inserted at an angle in closer accordance to the requirements of prosthodontic parallelism. It is for these reasons that we chose this implant system to demonstrate mainstream treatment of posterior partial edentulism, where less bone tends to be available than in the anterior. Similarly, the system that represents mainstream treatment of full mandibular edentulism with a root form-supported overdenture requires fewer surgical interventions than many other available systems, and promotes prosthodontic simplicity (Fig. 2-8). The system in the single-tooth replacement teaching case was selected because of the long-term success demonstrated by clinical trials that investigate this specific type of treatment using this implant system, and because its stepped body design (Fig. 2-9) is specifically designed for placement into immediate extraction sites in appropriate cases, again expanding scope of treatment.

\textbf{Figure 2-6} Adjusting plate/blade forms for enhanced parallelism at time of insertion.

\textbf{Figure 2-6} Adjusting plate/blade forms for enhanced parallelism at time of insertion

\textbf{Figure 2-7} Bone growth within interconnecting porosities (\textit{left}) of diffusion-bonded microsphere interface (\textit{right}).
Figure 2-7 Bone growth within interconnecting porosities (*left*) of diffusion-bonded microsphere interface (*right*).

Figure 2-8 Root form transfer copings for direct impressioning at time of implant insertion.

Figure 2-9 Stepped body design for insertion into immediate extraction site.
Finally, the configurations within each implant system that are described throughout the book are chosen based on the diagnosis and anatomy of available bone of each case.

**CLASSIFICATION OF IMPLANT MODALITIES**

*Endosteal Implants*

Endosteal implants comprise one broad category of implants. The most commonly applicable abutment-providing modalities are endosteal. In mainstream cases, endosteal implants are placed within fully or partially edentulous alveolar ridges with sufficient residual available bone to accommodate the selected configuration.

Some endosteal implants are attached to components for the retention of a fixed or removable prosthesis. Other endosteal implants are equipped with an abutment integral with the implant body, which protrudes into the oral cavity during healing. Endosteal implant systems are commonly referred to as one-stage or two-stage. Sometimes these terms are used to describe the number of required surgical interventions. In this book, endosteal implant systems that require attachment of abutments or other attachment mechanisms at a visit subsequent to the insertion visit are referred to as two-stage, and those that are equipped with an integral abutment at the time of insertion are referred to as one-stage. Therefore, what some manufacturers call "one-stage," meaning that only one surgical intervention is required, is what this book refers to as the two-stage semi-submersion healing option, in which a healing collar is placed flush with or up to 1 mm above the gingiva at the time of implant placement, thus avoiding the implant exposure surgery associated with submersion under the gingiva at the time of implant insertion.

*Root Forms.*

Root form implants are designed to resemble the shape of a natural tooth root. They usually are circular in cross section. Root forms can be threaded, smooth, stepped, parallel-sided or tapered, with or without a coating, with or without grooves or a vent, and can be joined to a wide variety of components for retention of a prosthesis.

As a rule, root forms must achieve osteointegration to succeed. Therefore, they are placed in an afunctional state during healing until they are osteointegrated. Semi-submerged implant healing...
collars are then removed, or submerged implants are surgically exposed for the attachment of components for the retention of a fixed or removable prosthesis. Thus, most root forms are two-stage implants. Stage one is submersion or semi-submersion to permit afunctional healing (Fig. 2-10), and stage two is the attachment of an abutment or retention mechanism (Fig. 2-11). Semi-submersion of root forms obviates the need for two surgical interventions, which represents an important improvement in the modality in terms of technique-permissiveness. Root form protocols require separate treatment steps for insertion and abutment or retention mechanism attachment whether the healing protocol calls for submersion or semi-submersion.
A root form can be placed anywhere in the mandible or maxilla where there is sufficient available bone. However, because of the diameter of root form implants, most mainstream treatment involves anterior insertion [3,4] for single-tooth replacement or restoration with overdentures. With the innovation of the diffusion-bonded microsphere interface, the mainstream applicability of this modality has increased in cases of posterior partial edentulism requiring five or fewer units of restorative dentistry. Tapered smooth and threaded cylinders also are fine choices for anterior edentulism. Figs. 2-12, 2-13, 2-14, 2-15 show typical mainstream root form cases.

**Figure 2-12** Root forms to support single-tooth replacements

**Figure 2-13** Crowns individually supported by root forms

**Figure 2-14** Root form-supported single-tooth replacement in mandible
Plate/Blade Forms.

As its name suggests, the basic shape of the plate/blade form implant is similar to that of a metal plate or blade in cross-section. Some plate/blade forms have a combination of parallel and tapered sides (Figs. 2-16 and 2-17). Just as screws and cylinders are both of the root form modality, plate forms and blade forms are both of the plate/blade form modality. Plate/blade form systems are supplied in one-stage and two-stage varieties (Fig. 2-18). One-stage plate/blade form implants are fabricated of one solid piece of titanium, with the abutment contiguous with the body of the implant. Two-stage plate/blade form implants are supplied with detachable abutments and healing collars. The one-stage and two-stage options exist so the practitioner can use the osteointegration or osteopreservation mode of tissue integration, according to the needs of the case. These modes of tissue integration are introduced in Chapter 6. Considerations in choosing the appropriate mode of tissue integration are discussed throughout the book.
**Figure 2-16** Profiles of Generation Ten and Standard plate/blade form implants

**Figure 2-17** Three-dimensional finite element model of plate/blade form with combination of parallel and tapered sides in a mandible

**Figure 2-17** Three-dimensional finite element model of plate/blade form with combination of parallel and tapered sides in a mandible
Plate/blade forms are unique among implants in that they can function successfully in either the osteointegration or osteopreservation mode of tissue integration. When mainstream protocols are followed, one-stage implants heal in the osteopreservation mode of tissue integration, and two-stage implants osteointegrate. As with two-stage root forms, two-stage plate/blade forms require a second treatment step for the attachment of abutments. However, two-stage plate/blade forms are designed to heal in the semi-submerged healing mode, so the second-stage removal of the healing collar and attachment of the abutment does not require a surgical intervention.

As with root form implants, plate/blade form implants can be placed anywhere in the mandible or maxilla where there is sufficient available bone. However, because of their narrower bucco/labial-lingual width, plate/blade forms tend to be applicable in a wider range of available bone presentations, especially in the posterior of the ridges. Plate/blade forms can be used for the majority of implant dentistry candidates, and in 100% of cases in which root forms can be inserted. Figs. 2-19, 2-20, 2-21 show radiographs of typical mainstream plate/blade form cases.
Endodontic Stabilizer Implants.

Although endodontic stabilizer implants are endosteal implants, they differ from other endosteal implants in terms of functional application. Rather than providing additional abutment support for restorative dentistry, they are used to extend the functional length of an existing tooth root to improve its prognosis\[6\] and when required, its ability to support bridgework. Modern endodontic stabilizers take the form of a long, threaded post that passes at least 5 mm beyond the apex of the tooth root into available bone. Endodontic stabilizers have been designed with parallel or tapered sides, smooth or threaded. The most successful endodontic stabilizers are threaded and parallel-sided, with sluiceways in the threaded crests that prevent apical cement sealant from being expressed into bone by guiding it crestally. The parallel-sided threaded design controls the stress concentration at the apex of the root, protecting against fracture and trauma.\[7\]

The endodontic stabilizer functions in the osteopreservation mode of tissue integration, because the tooth root through which it is inserted is subjected to normal physiologic micromovement as it heals. Endodontic stabilizers are placed and the procedure is completed in one visit, as the final step of any conventional endodontic regimen.

The range of applicability of the endodontic stabilizer is dictated by the need for at least 5 mm of available bone beyond the apex of the tooth being treated, and the need to avoid certain anatomic landmarks. Five millimeters of available bone is the minimum that can increase the
crown-root ratio to an extent sufficient to affect positively the prognosis of the tooth. In the mandible, the first premolar and the teeth anterior to it are good candidates for endodontic stabilization. The second premolar and molars are over the inferior alveolar canal, and therefore are usually not good candidates for mainstream endodontic stabilization. In the maxilla, the teeth most often treated are the centrals, laterals, cuspids, and the lingual root of first premolars. The second premolar and molars are under the maxillary sinus, and therefore usually are not good candidates for mainstream endodontic stabilization. Figs. 2-22 and 2-23 show radiographs of typical mainstream endodontic stabilizer cases.

**Figure 2-22** Endodontic stabilizers lengthening tooth roots in anterior mandible.

**Figure 2-23** Endodontic stabilizer lengthening tooth roots in anterior maxilla.

**Ramus Frame Implants.**

Ramus frame implants have been demonstrated to be safe and effective. They are intended for the treatment of total mandibular edentulism with severe alveolar ridge resorption. Ramus frame implants do not have mainstream applications because of technique-sensitivity. They feature an
external attachment bar that courses a few millimeters superior to the crest of the ridge from ascending ramus to ascending ramus. Posteriorly on each side, an endosteal extension inserts into available bone within each ascending ramus. Anteriorly, the bar is contiguous with a plate/blade form type of extension that is inserted into available bone in the symphyseal area. [Fig. 2-24] shows a radiograph of a ramus frame in position.

**Figure 2-24** Mandibular ramus frame implant with overdenture. *(Courtesy Dr. Jerry Soderstrom, Rapid City, SD.)*

![Radiograph of ramus frame implant with overdenture](image)

Transosteal Implants.

Among endosteal implants, transosteal implants are the most surgically invasive and technique-sensitive. As with ramus frame implants, they are limited to the mandible. Although transosteal implants have proven safety and efficacy, they are not considered mainstream because of their complexity and the demands they make on both the practitioner and the patient. Transosteal implants feature a plate that is placed against the exposed inferior border of the mandible, with extensions that pass from this plate through the symphyseal area, out of the crest of the ridge, and into the oral cavity. [Fig. 2-25] shows a presentation model of a typical transosteal implant case in the mandible.

**Figure 2-25** Presentation model of transosteal implant.

![Presentation model of transosteal implant](image)

Subperiosteal Implants
The subperiosteal implant modality is distinct from the endosteal implant modalities in that the implant is placed under the periosteum and against bone on the day of insertion, rather than within alveolar bone. This modality is used in cases of advanced alveolar resorption, in which the volume of the residual available bone is insufficient for the insertion of an endosteal implant.\(^{19}\) The subperiosteal implant is retained by periosteal integration, in which the outer layer of the periosteum provides dense fibrous envelopment and anchors the implant to bone through Sharpey’s fibers\(^{11,12,13}\) and also by retentive undercut features of the implant design. Subperiosteal implants are custom-made and are of four types. Unilateral subperiosteal implants usually are placed in severely resorbed premolar and molar areas of the mandible or maxilla, where there are no distal natural abutments. Figs. 2-26 and 2-27 show radiographs of typical mainstream unilateral subperiosteal cases.

**Figure 2-26** Unilateral subperiosteal implant in mandible.

**Figure 2-27** Unilateral subperiosteal implant in maxilla.

An interdental subperiosteal implant spans a severely resorbed edentulous area between remaining natural teeth. These implants can be used anteriorly or posteriorly in either arch. They are rarely indicated but nonetheless are considered mainstream in the rare cases in which they are applicable. Fig. 2-28 shows a radiograph of a typical mainstream interdental subperiosteal case in the maxilla.  

**Figure 2-28** Interdental subperiosteal implant in anterior maxilla. (Courtesy Dr. Terry Reynolds, Atlanta, Ga.)
Figure 2-28 Interdental subperiosteal implant in anterior maxilla. (Courtesy Dr. Terry Reynolds, Atlanta, Ga.)

Total subperiosteal implants are for patients who have lost all of their teeth in one arch (Fig. 2-29). Such treatment is not considered mainstream but can be performed after experience with a number of unilateral or interdental cases.

Figure 2-29 Total mandibular subperiosteal implant. (Courtesy Dr. Walter Knouse, Lumberville, Pa.)

Finally, a circumferential subperiosteal is a modification of a total subperiosteal implant but is used in cases in which several anterior teeth are still in position. Circumferential subperiosteal cases are most often mandibular. The lingual and buccal main bearing struts are designed such that the connecting struts are distal to the last natural tooth on each side, allowing the entire implant to pass over the anterior teeth to rest against basal bone. The circumferential subperiosteal is akin to two unilateral subperiosteals that are connected with anterior labial and lingual main bearing struts.
In mainstream unilateral subperiosteal treatment, two surgical interventions are required—the first to take a direct bone impression to obtain a model from which the custom-made implant is fabricated, and the second to place the implant. Although the application of computer-generated bone modeling is promising (Fig. 2-30), it is not yet considered to be a mainstream technique for obtaining an accurate bone model in unilateral cases.

Figure 2-30  Computer-generated mandibular bone model. (Courtesy Dr. Jerry Soderstrom, Rapid City, SD.)

Intramucosal Inserts

Intramucosal inserts differ in form, concept, and function from the other modalities. They are mushroom-shaped titanium projections that are attached to the tissue surface of a partial or total removable denture in the maxilla\(^{19}\) and plug into prepared soft-tissue receptor sites in the gingiva to provide additional retention and stability. Thus, they provide support for a prosthesis but do not provide abutments. They are used in the treatment of patients for whom endosteal or subperiosteal implants are not deemed to be practical or desirable.

Intramucosal inserts do not come into contact with bone, so the mode of tissue integration is not osteointegration, osteopreservation, or periosteal integration. Rather, the receptor sites in the tissue into which the inserts seat become lined with tough, keratinized epithelium. In this sense, seated intramucosal inserts are external to the body. Only one appointment is required for the placement of intramucosal inserts.

For reasons that are described in detail in Chapter 20, intramucosal inserts are best used in the maxilla. Because of complicated biomechanics, more acute alveolar ridge angles, a wider array of applied forces, and insufficient gingival thickness, placement of intramucosal inserts in the mandible is not recommended. Figs. 2-31 and 2-32 show radiographs of typical mainstream intramucosal insert cases in the maxilla.

Figure 2-31  Large intramucosal inserts in position.
REFERENCES


