Implant maintenance and the dental hygienist

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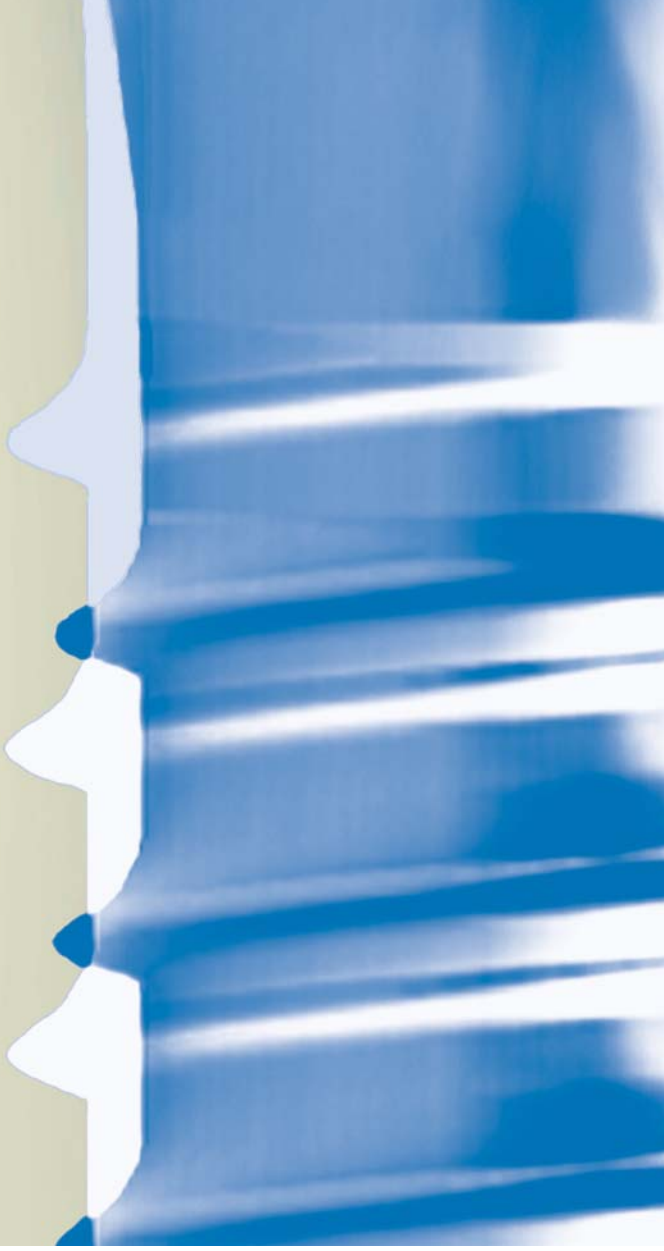

About the Author

Sheri Granier Sison, RDH, BS, is clinical instructor and faculty co-supervisor of the Implant Clinic at the Louisiana State University Health Sciences Center School of Dentistry.

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Introduction

Edentulousness is on the decline, but it will increase dramatically in the adult population older than 55 years. One study suggests that despite the 10% decline in tooth loss in each of the last three decades, the 79% increase in the senior population will result in 37.9 million adults requiring one or two complete dentures in 2020.[1] The prevalence in tooth loss in the United States for adults 18 years or older is 9.7% and increases to 33.1% at 65 years or older.[2] Missing teeth can cause loss of self-esteem and have an impact on social interaction.[3] The diminished masticatory efficiency accompanying tooth loss can compromise nutritional status, putting clients at higher risk for chronic illnesses like diabetes, cancer, hypertension, and heart disease.[4]

Conventional dentures typically attain only limited success with respect to both client satisfaction and chewing ability. An implant-retained prosthesis provides greater stability, improved biting and chewing forces, and higher client satisfaction than a conventional denture.[5-11] Dental implants also may be used to replace teeth in a client who is partially edentulous. Osseointegration provides support for function, while dental implants are used as replacements for natural teeth. Technological advances have allowed for the increased acceptance and use of dental implants in a variety of restorative treatments.

An implant-retained prosthesis provides greater stability, improved biting and chewing forces, and higher client satisfaction than a conventional denture.

The dental hygienist is involved in all facets of client care, the consistency of which leads to enhanced relationships. Combined with maintenance skills, strong client/caregiver bonds allow the dental hygienist to function as a vital member of the dental implant team.[12] A comprehensive knowledge of implant dentistry allows the dental hygienist to function in many of the stages of dental implant therapy and help the therapist perform a great service to the client who requires prosthodontic treatment. This supplement discusses the indications for dental implants, maintenance and monitoring of implants, and the role of the dental hygienist in successful implant-based prosthetic treatment.

The Role of the Registered Dental Hygienist

Terracciano-Mortilla suggests that the dental hygienist perform a variety of duties as a member of the implant team.[13] One of the initial duties is the identification and education of potential implant candidates. The success of the implant relies heavily on the health of the implant environment. Control of bacterial plaque through home care has been related to periimplant bone loss.[14] Implants should not be placed in the client who cannot demonstrate an effective home-care regimen.[15] An implant candidate must understand and accept the time and financial commitment that the procedures require. The dental hygienist should also be aware of the client's overall health history. There should be minimal risk to the client undergoing surgery, and the client should be free of any systemic illnesses or other factors that may delay healing.[16-19] Finally, the client must have adequate bone in which to place the implant. An ideal radiographic assessment of bone displays quantity of bone in three dimensions, anatomical landmarks, and the quality of available bone.[20] For clients with inadequate bone, surgical procedures such as guided bone regeneration, bone grafts, or bone substitutes may be considered.[21,22] A client who meets these criteria should be educated about implant dentistry and further evaluated as an implant candidate.

According to Terraccino-Mortilla, the dental hygienist should develop client-specific home care routine for the implant client.[13] This is a dynamic process, because home care must be altered with each stage of the dental implant including post-surgical hygiene, provisional restoration, and final restoration or prosthodontic delivery. In the delivery of oral hygiene instruction, the dental hygienist should also provide client motivation. Tissue destruction in the periimplant site is prevented by the absence of bacterial plaque, and the client must participate in primary preventive measures.[23-28] Compliant clients are ideal candidates, since implants are maintenance intensive. Noncompliant clients need to be fully educated and thoroughly trained before implant therapy begins.[29] Behavior modification is essential in these situations. The client should be discouraged from becoming complacent with home care and understand the importance of plaque control and tissue health. Clients that lost their teeth due to poor self-care can easily return to previous neglectful behaviors.[30]

The maintenance appointment allows the dental hygienist to participate in many aspects of implant treatment. Assessment of tissue health can allow for early intervention in the disease process. Although the soft tissue surrounding the implant is similar to the environment of a natural tooth, the periimplant connective tissue is more vulnerable to infection due to decreased vascularity and lack of true connective attachment.[15,31–34] Clinical assessment includes determining the presence or absence of bacterial plaque, bleeding on probing, and exudate.[32,35,36] Investigators are sharply divided on the issue of periodontal probing in the

implant environment. It has been suggested that probing of the implant sulcus is not truly diagnostic and can be detrimental to the delicate attachment.[15,33,36,37] It also has been suggested that probing is indicated only in implants where pathology such as bleeding and exudate is present.[32,38] Tissue health is a strong predictor of the long-term success of the dental implant. Assessment of the implant soft tissue should be accompanied by a radiographic examination of the hard tissue surrounding the implant. Radiographs should be evaluated for the presence of radiolucencies and excessive bone loss.[15,32,33,36,37,39,40]

During the maintenance appointment, the dental hygienist should remove deposits of any nature, including soft plaque and calculus. Debridement is accomplished with implant-safe instruments. Plastic, graphite, and gold-tipped instruments can be used to remove deposits without damaging the implant surface (Figures 1-3). An ultrasonic tip may be used only with a plastic covering that prevents gouging and disturbance of the titanium surface. Polishing the visible portion of the implant can be accomplished with rubber cups and nonabrasive polishing paste or tin oxide.[15,32,39-41] In the first year following restoration of the implant, the client should be evaluated every three months. The dental hygienist should take oral hygiene, tissue health, and amount of deposits into consideration to determine a client-specific recall system after the initial 12-month period. A four- to six-month recare system should be used dependent on the individual factors.[15,32]

According to Terraccino-Mortilla, the dental hygienist should document all findings.[13] Documenting of baseline data is important, as changes can be an early predictor of impending problems. Baseline data should include the prosthesis design, hard and soft tissue evaluation, occlusion, radiographs, implant mobility, and procedures performed to maintain the implant. Oral hygiene status and the client's responses and attitudes should be documented. Management of data can be accomplished by use of a special form that follows the course of the implant from baseline data collection.[42] Finally, the dentist should be informed of the status of the implant so that problems can be addressed expeditiously.[13]

Early Etruscans replaced missing teeth with artificial teeth carved from the bones of oxen.

History of Implants

The dental implant has a lengthy history, beginning with ancient Egyptians, who implanted teeth in corpses in accordance with religious beliefs regarding the afterlife. According to evidence discovered in underground burial chambers in what is now modern Italy, early Etruscans replaced missing teeth with artificial teeth carved from the bones of oxen. The Romans conquered the Etruscans and employed their dental techniques until the fall of Rome. The earliest endosseous implant was discovered in a mandible fragment of Mayan origin dating from about A.D. 600. Radiographs showed compact bone formation around three tooth-shaped pieces of shell implanted in sockets of missing lower incisors, similar to the bone surrounding a modern blade implant.[43]

Innovations in dentistry dwindled following the fall of the Roman Empire, but they were revived during the Renaissance. By the 1800s, fixed bridges and partial dentures were successful methods of tooth replacement. In 1885, Dr. J.M. Younger implanted a natural human tooth into an artificial socket. Younger's procedure included filling the pulp chamber of the tooth with gutta percha and the apical opening with gold. A tooth from any source was acceptable, according to Younger, provided that asepsis was maintained. Although his work was largely unsuccessful, it spurred many later attempts at implantation. Technical advances include implanted tubes of gold and iridium, lead and porcelain posts, and bovine incisor teeth into natural or artificially created sockets.[43]

In 1948, two American dentists, Gershoff and Goldberg, surgically placed a subperiosteal implant created by Dr. Gustav Dahl of Sweden. The subperiosteal implant was prefabricated based on a study model. This method of implantation met with limited success and proved over time to have a high failure rate due to infection.[43] In 1965, Swedish orthopedist P. I. Brånemark placed the first titanium implant and coined the term "osseoin-

Figure 1. Plastic scaler.

Figure 2. Graphite scaler.

Figure 3. Gold-tipped scaler.

tegration."[44] Osseointegration—incorporation of the implant with the bone—is one of the greatest achievements in implant dentistry. In 1967, Dr. Leonard Linkow of New York City placed the first blade implant, and by the 1970s, this was the most frequently employed implant design.[44]

Types of Implants

A subperiosteal implant is not placed within alveolar bone, but under the periosteum, against the bone. This type of implant is custom-made from a direct bone impression. This requires two surgeries—the first for fabrication and the second for implant placement. The subperiosteal implant is rarely indicated except for severely resorbed edentulous areas.[45] Atrophic changes in the edentulous jaw are common, causing implant mobility and decreased stability, and facilitating infection.[46] Subperiosteal implants are rarely seen today because they were commonly removed due to complications. The client with the subperiosteal implant must be continuously monitored and the implant must be removed upon infection to prevent extensive damage to the alveolus.[47,48]

Endosteal implants have proven successful in single-tooth replacement as well as in the edentulous arch. One or two surgical interventions may be required for placement. One-stage implants are placed in a single surgery, and a healing collar is placed at or above the gingiva. This eliminates a second surgical procedure to expose the implant, as completes the two-stage procedure where the implant is completely submerged under the gingiva at insertion.[45]

Transosteal or transmandibular implant (TMI) reconstruction systems are indicated only for the severely resorbed mandible. They are an invasive and technique-sensitive form of endosteal implants. Bone loss is stopped and bone growth may be induced by the TMI system. TMI is more invasive than other implants and usually requires hospitalization. Scientific literature indicates success with this system, although it is very demanding for the client and the practitioner.[49]

Blade or plate-form implants are also considered endosteal implants. Blades, successfully used in a variety of bone widths and heights, can be placed anywhere in the mandible or maxilla with sufficient bone. They can be placed when a client does not have adequate bone for a cylindrical implant and are appropriate for most implant candidates. Blade implants have been used with success for the last 30 years.[50,51]

Similar to the shape of a natural tooth root, root-form implants can be placed in the mandible or maxilla with adequate bone. This endosteal implant can also be placed in one or two stages.[45] Although root-forms require osseointegration achieved in a two-stage procedure, no significant differences in the success of one-stage or two-stage insertion are noted in the literature.[52-56] The root-form implant has been studied more than any other implant form. It has consistently proved safe and efficacious in the support of prosthodontic restoration.[45]

To be considered for implants, the client should be categorized as to classification of presurgical risk, as set forth by the American Society of Anesthesiology.

Client Assessment

Initial assessment of an implant candidate should include a thorough medical, dental, and psychological evaluation. To ensure success of the implant, the client must be in good oral and physical health. Because the implant is maintenance intensive, the implant client must also be prepared to maintain the health of the restoration.

The first consideration is the client's medical history. Vital signs such as blood pressure, pulse, and respiration should be assessed and documented to determine if the client is capable of undergoing surgery requiring anesthetic and pain-controlling medications. Basic lab work such as blood count, urinalysis, or sequential multiple analyzer of the blood chemistry (SMAC) can assist in ruling out systemic complications.[16,57]

To be considered for implants, the client should be categorized as to classification of presurgical risk, as set forth by the American Society of Anesthesiology.[57,58] Class I includes the client with no systemic illnesses and a normal lifestyle. Clients with well-controlled systemic illnesses who are able to engage in normal daily activity are categorized as Class II. Clients in classes I and II are usually considered implant candidates. A client with impaired activity because of a chronic condition or multiple medical problems falls into Class III, and may be a candidate for implants but will require certain measures prior to surgery to stabilize systemic problems. Clients in classes IV and V have serious medical conditions and are not appropriate implant candidates.[57,58]

Clients who have chronic illnesses that could compromise healing should not have implants placed. Bleeding disorders, connective tissue disorders, chronic steroid therapy, and immunosuppression therapy can hinder healing and therefore osseointegration. Clients who have well-controlled diabetes have shown no higher incidence in implant failure; however, an uncontrolled plasma glucose level can have a negative effect on the healing potential of the

implant, so that is a contraindication for implant treatment.[59,60] Tobacco use has also been statistically associated with implant failure. The clinician should address the impact smoking has on implant survival and may choose not to place implants in smokers.[61]

Psychological evaluation of the implant candidate includes intangible factors that affect the outcome of the restoration. The client must have realistic expectations of the restoration in regard to its usefulness and aesthetic value. The practitioner should take into account the needs and desires of the implant candidate, and fully inform the client how these will be met.[57] The types of procedures expected, as well as the expected impact of transitional restorations, should be disclosed to the client. The client also should have a realistic concept of the time commitment required. He or she should be fully apprised that implant placement and restoration involves a number of stages and need ample time for healing and osseointegration.

With respect to the cost of implants, the client should be aware that the financial commitment includes paying not only the implant placement, ancillary procedures, and restoration fees; but also the required ongoing maintenance costs. Maintenance requires three-month visits and radiographs in the first year following restoration and four- to six-month recare afterward.[32,40] There also may be a need to replace devices used to integrate the implant and the prosthesis. The client must have the ability to maintain oral hygiene throughout treatment to protect the healing implant site from pathogenic bacteria.

A thorough dental evaluation should be performed that includes questioning the client regarding dental history. Identification of the cause of the client's tooth loss is imperative. The client who lost teeth as the result of trauma or an accident will likely be more compliant in home-care than the client who lost teeth due to disease and/or neglect.[62] The client who is typically noncompliant will require thorough education and should demonstrate compliance and a commitment to home-care and maintenance visits before implant therapy is initiated.[15]

The client who became fully edentulous as a result of periodontal pathogens is at no greater risk for periimplantitis due to periodontal pathogens. A literature review by Quirynen et al. indicates that, a month after dental extraction, certain known periodontal pathogens can no longer be detected.[63] The levels of pathogens remain barely detectable after replacement of the teeth by implant-supported prostheses. There also is a strong similarity in subgingival plaque composition in implants and teeth in the partially edentulous clients. A tooth with advanced periodontitis can act as a reservoir for periodontal pathogens; therefore, partially edentulous clients are at greater risk for periimplantitis.[41,63] This promotes the notion that a good implant candidate is one who is etiology-controlled and free from dental diseases.[15]

The client who became fully edentulous as a result of periodontal pathogens is at no greater risk for periimplantitis due to periodontal pathogens.

Dental evaluation of the implant candidate must include a thorough radiographic examination to allow evaluation of the alveolar bone. By considering the anatomy of the implant site, the practitioner can determine the prescribed radiographs. A periapical radiograph shows the location of tooth roots and opaque foreign bodies that can affect the implant site. However, it does not indicate bone width and so is limited in this indication. Panoramic radiographs can be used to locate anatomical landmarks such as the maxillary sinus or inferior alveolar canal that can affect the suitability of the implant; also, panoramic radiographs can adequately depict bone height. Like the periapical X-ray, it is inadequate for the examination of bone width, but is commonly employed in initial treatment planning or screening.[20,64]

Digital radiography is rapidly evolving and has shown tremendous potential in generating images in panoramic and periapical films. Occlusal radiographs can be used only to evaluate the mandibular symphysis, so they are limited in their applicability. The relationship of the maxilla, mandible, and skull base may require evaluation in certain cases such as the completely edentulous client or the client who may require orthognathic correction. The lateral cephalometric radiograph may be indicated in these cases.[64]

Computer axial tomography (CT) enhanced with special dental processing programs provides the greatest detail with panoramic, cross-sectional, and three dimensional views of the mandible or maxilla. The CT scan can predict bone volume and density as well as the accurate position of anatomical landmarks; however, cost, access, and radiation exposure must be weighted against the advantages before the client undergoes a CT scan.[20,64]

The oral examination should take radiographic determinants into account. The client must have adequate bone width and height for placement and osseointegration of the implant. Positioning of the implant is key and the partially edentulous client must have adequate spacing. The client's gingival tissues should be examined for adequacy and health.[57]

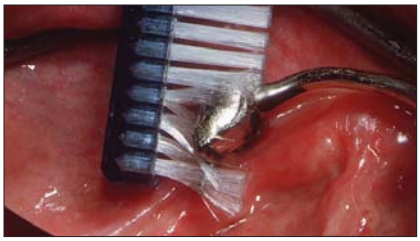

Figure 4. Soft bristle brush.

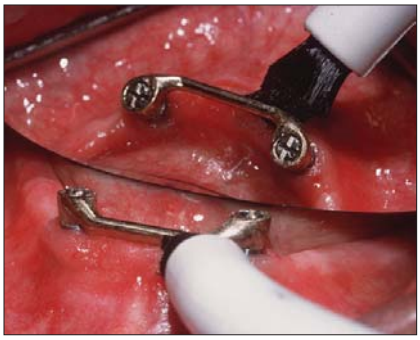

Figure 5. Example of a power toothbrush with multiple brush tips that allows complete access around an abutment.

Figure 6. Yarn.

Figure 7. Tufted floss.

Hard-tissue and soft-tissue assessment should include mounted study casts. The client may require preliminary treatment, such as periodontic, orthodontic, or restorative treatment, to obtain dental health or facilitate implant therapy.[57]

Treatment Planning

Joint treatment planning for implant procedures can begin when oral health is achieved; home care is effective; and the client is fully educated as to costs, implications, and treatment options. The key to success in this stage is effective communication between the involved parties. The restorative dentist should have a conference with the surgeon who will be placing the implants. Specialists who may be providing ancillary treatment, the dental hygienist, and the laboratory technician also may be included. Considerations for the dental team should include the client's medical, dental, and psychological status. Providers delivering preliminary treatment such as periodontal therapy, extractions, or orthodontics can inform the dental team of client progress. Throughout early treatment or team discussions, the client's unsuitability as a candidate for implant treatment may be discovered. At this point, alternate treatment plans including fixed bridgework and partial or complete dentures should be presented to the client.[57]

The implant team should be mindful of the client's needs and desires and work in cooperation to provide optimal restoration. The restoring dentist should create a definitive treatment plan for the client. A diagnostic wax-up should be made in anticipation of the final restoration. This will allow the dentist to consider spatial relationships and the alignment of the implants in the context of the existing teeth. Working with the surgeon to fabricate a surgical template, the dentist can help achieve proper alignment and placement of the implant.[57]

The client should be fully aware of how treatment will proceed. His or her obligation to maintenance of the implant, including home care and dental visits, should be outlined. The practitioner should discuss possible complications and the client should have realistic expectations of the outcome of the restoration. Fees and methods of payment should be reviewed and agreed upon beforehand, and a written consent should be signed by the client for both surgical and restorative treatment.[57]

Surgical Placement of the Implant

Throughout all phases of implant treatment, the dental hygienist functions in the primary prevention of disease at the implant site. The dental hygienist must make home-care modifications and provide reinforcement to the client at each stage. Following the initial placement of the implant or the first stage of treatment, the client must be advised of the need for gentle but thorough home care. Sutures and client avoidance of the surgical site should be addressed as mismanagement of them can lead to retention of plaque at the implant site.[13] Vertical crestal bone defects have been noted in one-stage surgery in the absence of plaque control in this initial healing period.[15,65] The client should be instructed to rinse with chlorhexidine gluconate or apply it with a swab or tufted brush twice daily. The substantivity of chlorhexidine combined with its antibacterial properties can assist in plaque control.[15,66]

This gentle debridement is effective only in the initial healing phase and a new home care regimen should be introduced subsequently to include a soft toothbrush. Single-tooth restorations can be managed with a soft toothbrush and floss. Clients who have provisional restorations also should be instructed in home care. Several devices can facilitate access to a fixed restoration, including an interdental brush, end-tuft brush, or an interproximal oral health aid. Superfloss or floss threaders also can remove plaque from abutment areas. The client should know where the abutments are and how to use oral hygiene aids to clean them.[13,15,67]

At stage-two surgery, the implant is exposed and a healing cuff is placed to promote tissue maturity. The client should rinse with chlorhexidine twice daily in the 14 days following exposure of the implant, and then implement mechanical debridement with a soft toothbrush or other aid. Chlorhexidine should still be used once a day and should be applied with the same aid used for mechanical debridement.[15]

Restoration of the Implant

When the tissue has adequately matured and the final restoration is delivered, the dental hygienist should again modify and reinforce home-care principles, considering access to the implant, client dexterity, and design of the final restoration.

A soft sulcular toothbrush is the primary plaque-control device for the implant abutment (Figure 4). A client with limited dexterity should use a power or sonic toothbrush. Certain power toothbrushes with multiple brush tips allow complete access around an abutment (Figure 5). Sonic and other powered brushes are also safe to use around the titanium abutment.[13,15,67,68]

Dental floss can be used to deliver chlorhexidine to the implant on a daily basis. The use of four-essential-oil rinses twice daily also has been shown to provide benefit to the implant client.[69] Floss should be inserted at the buccal surface of the implant, threaded around the lingual aspect, and crossed back to the buccal to completely surround the abutment.[67] Gauze strips, yarn, or thicker dental floss or dental tape can assist with plaque control in wide embrasures (Figures 6 and 7).[13,67]

A client who is not able to use floss can be instructed in the use of the interdental aids. The clinician should consider the embrasure size and shape in the selection of the interdental aid. An interproximal brush is indicated when embrasure space permits (Figure 8). The wire center of the brush should be coated with plastic or nylon to prevent scratching of the implant surface. An end-tuft brush can access smaller spaces and be manipulated under hot water to accommodate the shape of the prosthesis (Figure 9). Foam tips, interproximal brushes, and disposable wooden picks are among the many auxiliary devices that can assist in plaque removal. Chlorhexidine or antiseptic rinses can be delivered with these interdental aids to enhance their effectiveness.[68]

Plaque control in a single-tooth replacement is relatively simple. The implant abutment is easy to access with a toothbrush and the client should be taught to clean the subgingival portion of the abutment. Chlorhexidine or antiseptic rinses should be delivered by floss daily. Auxiliary aids can be used by clients who are unable to floss or have posterior restorations that are difficult to maintain.[68] Adequate oral hygiene is required for all natural teeth to maintain health and prevent the emergence of periodontal pathogens that can rapidly destroy delicate periimplant tissue.[13,30,48,67]

A prosthesis that is fixed to the implants and is not removed by the client requires a more detailed home-care regimen. Access to the implants is often limited by esthetic demands. The dental hygienist should develop a maintenance plan for the client that effectively removes plaque from proximal surfaces. Powered toothbrushes, floss with threaders, and interdental aids can all be used with fixed-implant prostheses. The delivery of chemotherapeutics such as chlorhexidine or antiseptic rinses is especially important because of the decreased access. If brushing or flossing in the lingual aspect is limited, an oral irrigation device can be used on a low setting. The irrigant should be directed through the contacts rather than into the tissue. Irrigation should be performed at the completion of the oral hygiene routine to remove materials that were loosened but not dislodged.[68]

Figure 8. Interdental brush for maintenance of implant-based fixed prosthesis.

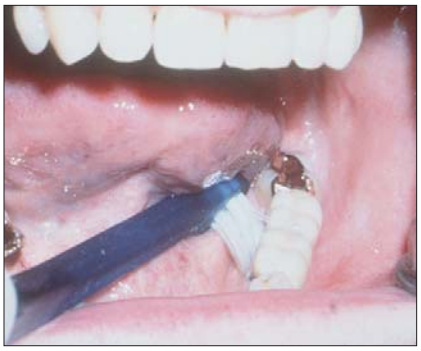

Figure 9. End-tuft brush.

Figure 10. Calculus buildup around a fixed bridge retained by and implant.

Clients who are able to remove their prosthesis have access to the implant abutment, and they may retain the denture with a bar or a ball attachment. It is imperative that these prosthetic attachments, as well as the implant abutments, be cleaned as a part of the oral hygiene program. Mineralized deposits can build up very quickly and interfere with the seating of the denture (Figure 10). A nylon flossing cord is abrasive enough to remove calculus and is indicated for the abutment surface, ball attachment, and ridge bar. The bar and ball attachments also can be cleaned with a soft-bristle brush, end-tuft brush, or interproximal brush. Dental floss, superfloss, gauze, or

yarn dipped in chlorhexidine or antiseptic rinse should be used around the implant abutment. All surfaces of the prosthesis must be cleaned with a stiff nylon denture brush daily.[13,29,30]

During each visit, the dental hygienist should assess the client's oral hygiene and make necessary modifications. Home care should be reviewed and reinforced with written instruction.[67] While there is no single oral hygiene aid that completely removes plaque, the clinician should keep in mind that compliance is dependent on the simplicity of the procedure, the amount of time it requires, and a minimal number of oral hygiene devices. Brushing should be the primary aspect of the oral hygiene program. To maximize compliance, only one auxiliary aid should be used, if possible.[30]

Brushing should be the primary aspect of the oral hygiene program. To maximize compliance, only one auxiliary aid should be used, if possible.

Mucogingival Tissues

Because of osseointegration, the implant can function as a natural tooth. However, it is unlike a natural tooth in its susceptibility to disease and the rapid destruction of the surrounding tissues. Although the soft tissue of the tooth and implant resemble each other, there are inherent differences in the connective tissues. The periodontium of a natural tooth consists of alveolar bone, periodontal ligament, cementum, and the gingiva. The implant is surrounded by periimplant tissues and lacks a periodontal ligament. The surface of the a tooth has a connective tissue attachment with collagen fibers inserted into the cementum. The connective tissue in the implant is compromised because collagen fibers run parallel to the implant surface without true attachment. It also is less vascular and has fewer fibroblasts than in the gingival structures around teeth.[32] This connective tissue attachment forms a barrier that protects the implant from bacteria and occlusal forces. The delicacy of this barrier should be kept in mind when probing or scaling the implant sulcus.

Baseline Data

Immediately following delivery of the final restoration, the dental hygienist should thoroughly document baseline data. Deviations from this initial data can be an early indicator of problems in the dental implant. The dental hygienist should begin by noting the prosthesis design. It also can be helpful to note any inherent problems in the design that can affect plaque removal. An account of the types of implants and their locations also should be recorded.[13]

Poor surgical technique, traumatic occlusion, or inadequacies in the prosthesis can all cause bone loss. This bone loss results in a reservoir for bacterial colonization and further breakdown of the periimplant tissues.[70] The hard-tissue evaluation should include radiographs, evaluation of occlusion, and examination of the prosthesis. Radiographs should be taken to monitor bone levels around the implant and evaluate the health of the bone. A periapical X ray with correct density and angulation, taken with a paralleling technique, can display marginal bone loss and components of the prosthesis.[15] The dental hygienist should document the radiographic technique and repeat it at future examinations to promote an accurate comparison.[13]

Because the attachment of the implant is different from that of a natural tooth, the implant is easily compromised by stress. An occlusal evaluation is required to assure that there are no excessive or traumatic stresses on the implant. Improper contacts, bruxism, or other occlusal discrepancies must be remedied to prevent bone loss. The prosthesis should have adequate contacts and embrasure spaces to facilitate home care.[13]

It has been clearly established that the periimplant tissue is susceptible to bacterial accumulation and subsequent infection. Soft-tissue examination at baseline allows for comparison of periimplant health at subsequent examinations. The benefit of probing the implant sulcus is a debatable topic, dependent on the investigator. The clinician should exercise personal judgment when deciding whether or not to probe apparently healthy tissue. In observing signs of infection, the clinician should probe the periimplant tissue.[32,38] Probing should be accomplished with a plastic periodontal probe (Figure 11). Ideal pocket depths are under 4 mm and there should be no bleeding. Color, consistency, and presence or absence of edema should be assessed by visual examination. Slight pressure on the soft tissue can produce bleeding, exudate, or tenderness in inflamed periimplant tissue. The clinician also should measure recession.[13] The absence of keratinized tissue has not conclusively been shown to predispose implant tissue to disease; however, the presence of keratinized tissue surrounding the implant can make oral hygiene procedures easier to accomplish.[71]

The dental hygienist should keep a record of the client's home-care procedures including recommended aids and chemotherapeutics. The client's responses and attitudes toward the home-care procedures should be noted as well. This will allow assessment of the success or limitations of this regimen in the future (Figure 12).[13]

Maintenance

In the first year following restoration of the implant, frequent recalls are needed. The client should be assessed every three months. Recall for the implant client after those initial 12 months should be dictated by the client's individual needs. These factors include stability of the implant tissues, periodontal health of the surrounding teeth, systemic health, and the effectiveness of home-care procedures.[32]

Maintenance visits include periimplant evaluations, prosthetic evaluations, deposit removal, home-care reinforcement and modifications, and radiographs when indicated. A comparison of findings to baseline data can indicate impending problems with the implant.[13]

In the first year of treatment, radiographs of the implant should be taken at each three-month recare visit. After that, an annual radiograph should be taken and compared to the baseline radiograph. Because of surgical trauma, it is reasonable to expect 1.5 mm of bone loss in the first year and 0.2 mm each year thereafter.[32,40] Excessive bone loss must be addressed immediately.

In the first year of treatment, radiographs of the implant should be taken at each three-month recare visit.

Implant mobility can be a sign of significant problems. Stability of the implant should be assessed at each recare appointment. Mobility can occur at the abutment-prostheses connection and requires repair.[13] Mobility of the implant body is more serious, as it implies a loss of integration.[15]

The prosthesis and attachments should be examined for adequacy and continued function. Mechanical difficulties in the prosthesis, such as a fracture, can cause excessive occlusal stress and contribute to periimplant bone loss.[40] There should be no undue force or occlusal stress on the implant. All surfaces of the prosthesis should be free of scratches, fissures, and gouges that can harbor bacterial plaque.[13]

The evaluation of the health of the periimplant tissue should include clinical inspection for signs of inflammation. The dental hygienist should also note the nature of deposits on the implant abutment. The presence or absence of debris, plaque, and supragingival or subgingival calculus should be noted and further quantified as light, moderate, or heavy.[13]

Removal of deposits should be accomplished only with instruments that are incapable of damaging the implant surface. A variety of instruments similar to curets and scalers are available in plastic, nylon, or graphite. Gold-tipped instruments can be used but must be examined before use for exposure of the underlying metal and should never be sharpened.[32] If a client is performing an effective home-care regimen, subgingival calculus should be light. Calculus is not firmly attached to the implant because of the nonporous titanium surface and should be easily removable. The dental hygienist should scale with short working strokes and light pressure to prevent trauma to the delicate periimplant sulcus. Upon insertion of the instrument, the blade should be closed against the abutment and then opened past the deposit. The deposit should be engaged apically with the stroke extending coronally. A horizontal, oblique, or vertical stroke should be used, depending on the location of the deposit.[13]

Prostheses can sometimes limit access of the scaler, and an ultrasonic or sonic scaler can facilitate removal of deposits. When using the sonic or ultrasonic device to scale the implant abutment, the metal instruments must be covered with plastic tips.[13,32,67] The air-powered abrasive unit is contraindicated by some investigators. A review of several studies examining several types of instruments and their effects on the implant surfaces reveals the air-abrasive unit to be safe and effective in removing deposits.[72-75] A rubber cup can be used to polish the implant surface with a nonabrasive paste or tin oxide.[15,32,67]

Figure 11. Use of the plastic probe.

Figure 12. Measuring the keratinized gingiva. The metal probe should never be used to probe around the implant.

As home-care factors greatly into health of the implant, the dental hygienist should motivate the client to continue the regimen. If home care has not been effective, the dental hygienist should question the client and attempt to resolve those issues. If the employed auxiliary aids are not effective, it may be necessary to modify or change the client's techniques or change the type of aid.

The dentist should be immediately be informed of any problems or concerns. Changes in implant health must be addressed immediately, as should problems related to occlusion, prosthetics, and mobility.[13]

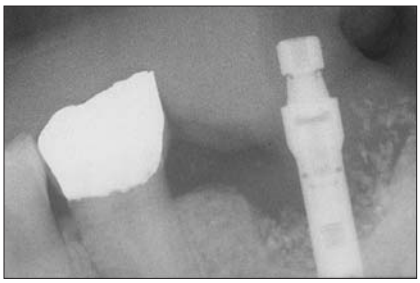

Figure 13. Radiograoph of a treated "ailing" implant.

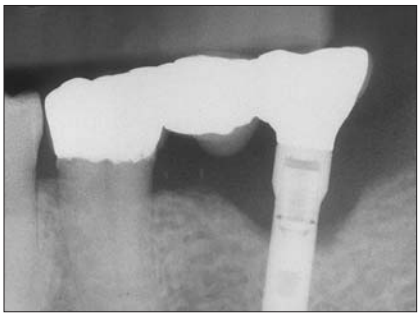

Figure 14. Radiograph of an "ailing" implant.

Figure 15. A failing implant with purulent exudate.

Ailing/Failing Implants

The biological reaction of the implant to pathogenic bacteria can have an impact in the long-term success of the implant. It is for this reason that thorough examination of the implant structures at maintenance visits is indicated. Changes in implant health can indicate if the implant is ailing or failing, or has failed.[38]

Periimplant mucositis is similar to gingivitis around a tooth in its bacterial etiology and its reversibility. This bacterial infection is marked by inflammatory changes with bleeding on probing, edema, and tenderness. Its unchecked progression can lead to periimplantitis, which affects the surrounding bone. Increased pocket depth, presence of exudate, and bone loss accompany the inflammation in the periimplant soft tissue (Figures 13 and 14).[15,32,33]

The ailing implant demonstrates radiographic bone loss without clinical inflammation. The pocket depth can be advanced but is marked by the absence of bleeding. The inflammatory process may have been arrested or bone loss could have resulted from trauma. The ailing implant must be monitored closely at each maintenance visit.[38]

The failing implant presents with consistent deterioration at maintenance intervals (Figure 15). Inflammation is present and observable with signs of bleeding, edema, redness, and exudate. There is no mobility, but radiographic bone loss is detectable. Intervention for the failing implant can be successful. Treatments include detoxification of the implant surface and surgical interventions. The source of the problem must be identified and eliminated.[38]

Implant failure is multifactorial and the cause may be unidentifiable. The progression of inflammation and traumatic forces can result in destruction of the bone. The failed implant presents with clinical inflammation, radiographic bone loss, and clinical mobility. There is no treatment for the failed implant and it must be removed.[38]

There is no treatment for the failed implant and it must be removed.

Summary

Although the dental implant requires constant maintenance and monitoring, it can be a predictable replacement for natural teeth. Studies have shown that implants can be superior to removable prosthodontics in aesthetics, stability, and chewing forces. From education to assessment, the dental hygienist is a constant in a dynamic process. The capacity of the dental hygienist to function within the implant team is a great benefit to the potential and current implant candidate.

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