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Recare protocol for implant-supported restorations: A chairside guide
Clinical guidelines for the management of peri-implant health

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Long-term success and patient satisfaction with dental implant restorations depend on efficient self-care by the patient, as well as professional care at intervals to be determined clinically. Otherwise, biofilm formation may result in peri-implant mucositis (etiologically similar to gingivitis in the natural dentition) that in turn may progress to peri-implantitis (etiologically similar to periodontitis) and subsequent loss of implants. This article outlines some of the requirements for optimal self-performed and professional infection-control procedures to minimize the risk of peri-implant disease developing.

Key Words: implant maintenance, peri-implant mucositis, peri-implantitis, supportive therapy

Introduction

As more patients opt for dental implant treatment, dental professionals must understand how to properly monitor and maintain the health of peri-implant tissues.1 More than three million Americans are estimated to have dental implants, with half a million more being added each year.2 Although favorable long-term results of implant therapy have been reported extensively, the microbiological challenge in the oral cavity may result in pathological reactions in peri-implant tissues, similar to those that may occur around natural teeth.3

As with natural teeth, there is evidence of a cause-and-effect relationship between bacterial plaque accumulation and the inflammatory lesions that develop in peri-implant tissues, collectively termed peri-implant diseases.4 Peri-implant mucositis is analogous to gingivitis around natural teeth5 (Fig. 1). It has been determined to be reversible. Estimates of the prevalence of peri-implant mucositis vary (Jepsen et al6 43%; Derks and Tomasii7 19-65%).

Although there are histological differences between peri-implantitis and periodontitis around natural teeth, peri-implantitis corresponds clinically with periodontitis (Fig. 2). The extent and severity of peri-implantitis varies; in one report, 16-28% of subjects exhibited severe bone loss around implants.8 It has been assumed that peri-implant mucositis is the precursor to peri-implantitis, just as gingivitis typically precedes periodontitis. One cause of peri-implant mucositis and peri-implantitis is residual cement around cement-retained restorations (Fig. 3).9

Both peri-implant diseases are considered to be infectious diseases. Therefore, the goal of treatment procedures should be elimination of the infection.10 However, evidence
Peri-implant mucositis involves inflammatory reactions in the mucosa surrounding implants without signs of supporting bone loss. The second type of peri-implant disease is peri-implantitis, which is characterized not only by an inflammation of the peri-implant mucosa but also by the loss of supporting bone.

Patient self-care
Immediately after delivery of implant restorations, patients should be given clear information and instructions on how to carry out effective plaque-control procedures (Fig. 4). With single- or multiple-unit implant-supported restorations, routine conventional oral hygiene measures may be adequate. However, with complex prostheses such as those designed for edentulous jaws, special adjuncts such as power brushes, interdental devices e.g. interdental brushes with nylon-coated wire (Fig. 5), and/or oral irrigators may be necessary to assist patients in achieving optimal oral hygiene. Care should be exercised in selecting appropriate toothpastes; some may contain harsh polishing agents that can scratch certain types of implant restorations such as hybrid prostheses with acrylic-resin denture bases. Significantly lower levels of dental plaque and gingival inflammation have been documented for implant patients using a dentifrice containing triclosan/copolymer, as compared to those using a standard fluoride toothpaste.12,13

Professional monitoring
Professional clinical examinations should be conducted at regular intervals. At a minimum, recare visits should occur annually, with supportive therapy given when indicated. The frequency of recare programs should be based on clinical evaluations and in accordance with recognized risk factors for peri-implant disease including plaque scores, smoking, a history of severe periodontitis, and metabolic disease. Typically, patients who present for implant...
treatment due to trauma or congenitally missing teeth and do not exhibit adverse periodontal conditions on the surrounding natural teeth may be seen every six months. However, partially edentulous patients who have lost their teeth due to periodontal disease and thus are susceptible to periodontal breakdown should be seen more frequently—such as every three to four months. Clinical examinations should always include plaque scores and assessments of bleeding on probing and pocket depths.

Clinical evaluation of the prosthesis
Using two mirror handles, the implant-supported prosthesis should be tested for any signs of lateral movement (Fig. 6). Any such movement may indicate screw loosening, loss of cement, or loss of integration. For cement-retained restorations, the security of the cement seal should be evaluated by attempting to elevate or dislodge the restoration/prosthesis with an instrument. For screw-retained prostheses, no movement or salivary percolation (bubbles) should be detected when a push/pull force is applied to the prosthesis with gloved fingers or instruments. Occlusal restorations for screw-retained prostheses need to be evaluated for mobility and/or loss of occlusal seal integrity at the recare appointment. If the restoration is loose or worn, it should be removed and replaced with a new restoration (Fig. 7).

Analysis of oral hygiene
Since supra-mucosal plaque formation is considered a risk factor for developing peri-implant disease, the patient’s oral hygiene should also be evaluated. Initially, the formation of biofilm and lack of its daily removal may result in peri-implant mucositis. Oral hygiene instructions should be reinforced, and the oral healthcare provider should make recommendations for any modifications to the recare program that could improve the patient’s ability to obtain optimal self-care.
Occasionally it may be prudent for the health-care provider to observe a patient performing oral hygiene procedures. Salvi and Ramseier\textsuperscript{14} state that professional and patient-administered mechanical plaque control alone should be considered the standard of care in the management of peri-implant mucositis. Active treatment of peri-implant mucositis is a prerequisite for the prevention of peri-implantitis.

**Detection of pathology**
The detection of bleeding and/or suppuration in the peri-implant mucosa requires probing the peri-implant pocket, preferably with a standardized pressure probe. The presence or absence of bleeding is the most relevant question to be answered. Clinical responses to probing include no bleeding (healthy peri-implant tissue), bleeding on probing with no increase in pocket measurements (peri-implant mucositis), or bleeding on probing with increased pocket probing depths (>2mm) as compared to previous probing depths (peri-implantitis). Clinical findings should always be noted with reference to the baseline data recorded on the day of prosthesis insertion, as well as subsequent recare visits.

**Probing**
Probing to monitor pocket depth/attachment loss is a routine part of monitoring the health of soft tissue around natural teeth.\textsuperscript{15} However, pocket depths measured around dental implants differ from those around teeth. Implants lack a layer of cementum covering the surface, and thus a connective tissue attachment similar to that around natural teeth does not exist.\textsuperscript{15} What does exist is a soft-tissue cuff in which collagen fiber bundles are present that are predominantly circumferentially oriented around the implant restoration. Also present are collagen fibers originating from the bone surfaces and oriented vertically and parallel to the implant surface (Fig. 8).\textsuperscript{16}
The consequence of this different orientation of the supracrestal connective tissue fibers is that the attachment around teeth is solid, whereas around implants it is fragile. This means that when using the same amount of pressure, differences will be found when probing pocket depths around implants and natural teeth. Around teeth, the probe will most likely stop at the depth of the epithelial attachment (the first supracrestal fibers). Around implants, the probe will most likely stop at the implant restorative platform or crestal bone. For this reason, a plastic standardized pressure probe is strongly recommended for use with implants (Fig. 9). It has been demonstrated that the point of a plastic standardized pressure probe ends approximately at the apical level of the epithelial attachment around a dental implant. A plastic probe also provides easier access because it can bend.

Unlike evaluation of the health of the gingival tissues around natural teeth, evaluation of the peri-implant soft tissues is not based primarily on pocket-depth assessment. A 6mm pocket (sulcular depth) might be present around an implant that was placed subcrestally in order to achieve optimal aesthetics. Abutment height therefore is influenced by peri-implant pocket depth (Fig. 10).18

Radiographs
Radiographs should be taken at the time of prosthesis delivery to provide a baseline for future bone-level evaluations (Fig. 11). If at any follow-up clinical evaluation, pocket depths have increased by more than 2mm when compared to the baseline, or if there are visible signs or symptoms of disease, additional radiographs are indicated. To enable accurate comparisons, radiographs should be taken in a consistent fashion, i.e. using a paralleling technique and in reproducible positions. One convenient method to evaluate the consistency of radiographs is to make sure the implant threads are equally visible on both sides of the implant. This indicates that the film/sensor was parallel to the implant’s long axis.

Fig. 8. Schematic illustration of the different orientations of supracrestal connective tissue fibers around a natural tooth (left) and an implant (right). A solid attachment has been described with teeth, whereas around implants the attachment has been described as a fragile adhesion.
Supportive Therapy

In the absence of bleeding on probing, there is no need for any treatment other than reinforcing satisfactory oral health habits (Fig. 12).\(^{19}\) If bleeding or suppuration is noted upon gentle probing, this may indicate the presence of biofilm and/or calculus that should be carefully removed with specifically designed instruments. Hard deposits can be removed with plastic scalers and/or curets that are safe for use around titanium implant abutments, implants, and/or aesthetic restorative materials.

Stainless steel instruments should be avoided as they may scratch or gouge abutments, creating reservoirs that can harbor bacteria. In most cases, a light exploratory stroke is all that is required to remove the deposits (Fig. 13). Hard deposits can also be removed safely with ultrasonic devices with modified PEEK (polyether ether ketone) fiber tips. It was recently demonstrated that safe and efficient removal of soft deposits for long-term implant maintenance can also be achieved with an air-polishing device with glycine or erythritol-based powders (e.g. the Air-Flow Method\(^{15}\), E.M.S. Electro Medical Systems S.A., Nyon, Switzerland). This specific device was shown to effectively remove both supra- and submucosal biofilms without damaging implant or abutment surfaces.\(^{20}\)

Polishing should not be performed using one prophylaxis paste for all tooth surfaces and aesthetic restorations. Selective polishing has been shown to be essential; the only polish that should be used on dental implant components and aesthetic restorative materials is one that will not damage the surfaces.\(^{21}\) When in doubt as to the type of restorative materials present, a non-abrasive cleaning agent such as ProCare\(^{18}\) Powder (Young Dental, Earth City, Missouri) should be used.

If bleeding on probing occurs in combination with probing pocket depths that have increased by more...
than 2mm from the previous recare appointment measurements, this indicates that peri-implantitis has developed. In this instance, radiographs should be taken to evaluate how much bone loss has occurred.

Although no treatment protocol has yet been proven to eliminate peri-implantitis and stop further bone loss, one clinical approach that has been proposed is to decontaminate the implant surface and recreate a surface on which bone can potentially re-attach.\(^{22}\) Though unpredictable, the best approach may include a combination of measures: open-flap debridement, removal of granulation tissue, debridement of the implant surface using a combination of chemical agents and mechanical instrumentation, and antibiotic supportive therapy, followed by an increase in the frequency of recare appointments.\(^{23}\) This approach may slow or stop further disease progression.

**Clinical Relevance**

Maintaining osseointegration is as important as achieving it. As the number of patients receiving dental implants increases, so must the focus on preventing and managing diseases such as peri-implant mucositis and peri-implantitis that may jeopardize long-term implant success. In addition to satisfying biologic and prosthodontic principles regarding implant restorations, professional supportive therapy and effective patient self-care are essential. Among the steps that are necessary to maintaining peri-implant soft- and hard-tissue health are daily plaque removal with toothbrushes (manual/power), interdental devices (floss), and/or other preventive adjuncts. Further research is needed to identify the specific differences between dental implant restorations and natural teeth regarding bacterial colonization and the attachment apparatus. As a greater understanding of these and other factors develops, it should be possible to refine implant-maintenance protocols to better ensure long-term success and high levels of patient satisfaction.
Occlusal Seal:

If the prosthesis is screw-retained, the integrity of the occlusal restoration over the screw-access opening should be evaluated. Any debris or calculus on the screw-access opening should be removed.

Oral Hygiene:

The patient’s oral hygiene (self-care) should be evaluated by noting the presence or absence of hard and/or soft plaques. The patient’s plaque control (self-care) should be evaluated.

Prosthesis Stability:

Using two mirror handles, an attempt should be made to move the implant-supported prosthesis. Any sign of movement may result in peri-implant mucositis, similar to gingivitis. Proper hygiene and maintenance of the prosthesis are crucial to prevent such issues.

Recare Protocol for Implant-Supported Restorations:

A step-by-step Recare Protocol is outlined to monitor and maintain dental implants properly. This includes:

1. Evaluation of the Occlusal Seal/Prosthesis Stability
2. Analysis of Oral Hygiene

The long-term success of dental implants as well as lasting patient satisfaction with implant therapy depend on proper maintenance and follow-up care.
STEP 3: Probing

Probing:
A plastic periodontal probe should be passed lightly around the implant abutment. Peri-implant soft tissue should be tightly adapted to the abutment and crown. The depth of the sulcular tissue should coincide with the length of each implant's abutment-collar height, as recorded on the day of prosthesis insertion. If any bleeding or suppuration are detected or the probing depth has increased, further evaluation is necessary. This may include removal of the prosthesis.

STEP 4: Radiographs

Radiographs:
Periapical radiographs should be obtained at the time of prosthesis insertion to verify the fit of the restorative components and establish a baseline for peri-implant bone height relative to the implant restorative platform. A radiograph may confirm misfit/loose components. If at any follow-up clinical evaluation, pocket depths have increased by more than 2mm when compared to the baseline, or if there are clinical signs of disease, additional radiographs are indicated.

STEP 5: Professional Debridement/Polishing

Debridement:
Plaque and calculus accumulations should be carefully debrided using instruments that are safe to use on titanium implants and abutments, such as plastic scalers. Stainless steel curets may scratch or gouge abutments, creating reservoirs to which bacteria can attach. A light exploratory stroke is usually sufficient to remove any deposits.

Polishing:
For polishing, no single prophylaxis paste works equally well on all tooth surfaces and aesthetic restorations. The only polish that should be used on dental implant components and aesthetic restorative materials is one that will not damage the surface.

By carefully and routinely evaluating patients' soft-tissue health and the stability of the prosthesis at professional recare appointments, the dental implant team can help ensure the long-term success of the implant-supported prosthesis and a continued high level of patient satisfaction.

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