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In Office Monitoring and Maintenance of Dental Implants

As more and more patients are opting for dental implant treatment, it is essential that both the general dentist and hygienist understand how to properly monitor and maintain the health of the peri-implant tissue. Natural teeth and dental implants differ not only in surrounding anatomy, but also in surrounding disease; the traits of which require a keen awareness to distinguish. Failure to make these distinctions can result in practices that contribute to iatrogenic crown loosening, bone loss, and even the loss of the dental implant itself. Dental implant maintenance is much more than just buying “implant scalers”.. As such, this article aims at providing a guideline for achieving appropriate monitoring and maintenance of dental implants.

The Gingival Sulcus. The normal pocket or space around teeth is called the gingival sulcus. Extensive research indicates that a sulcular depth of three millimetres or less constitutes a healthy state that remains self-cleansable. Two basic types of pocketing exist in sulcular depths greater than 3mm: the gingival pocket and the periodontal pocket. Both pockets are extensions of the gingival sulcus.

Gingival Pocket. A gingival pocket occurs when there is gingival hyperplasia. If the pocket depths have increased from previous recordings, they may create the illusion that periodontal pockets have developed. This is also known as a ‘pseudopocket.’ In this situation, the epithelial attachment is at same level as found in health, while the gingival margin has migrated in a coronal direction. In a gingival pocket, no destruction of the connective tissue fibres (gingival fibres) or alveolar bone occurs. This condition can be completely reversed only when the aetiology of the edematous reaction is eliminated.

Periodontal Pocket. As the original sulcular depth increases and the apical migration of the junctional epithelium has simultaneously taken place, pathosis has occurred. To have a true periodontal pocket, a probing measurement of 4 mm or more must be clinically evidenced. In this state, much of the gingival fibres that initially attached the gingival tissue to the tooth have been irreversibly destroyed.

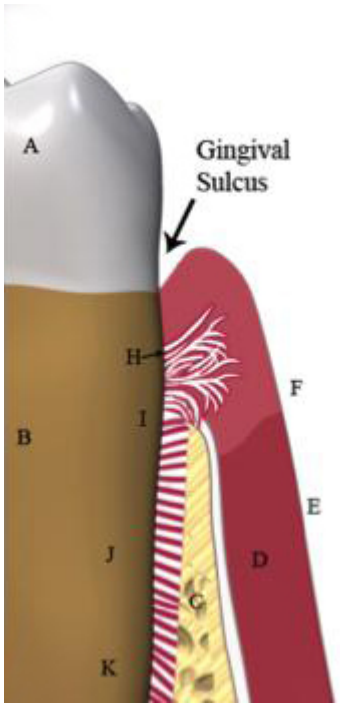


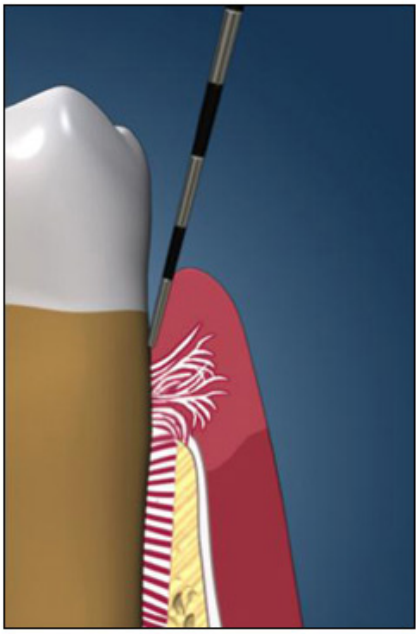
Figure 1. Anatomy of the periodontal complex. A, crown. B, root of the tooth covered by cementum. C, alveolar bone. D, subepithelial connective tissue. E, oral epithelium. F, free gingival margin. H, principle gingival fibres. I, alveolar crest fibres of the PDL. J, horizontal fibres of the PDL. K, oblique fibres of the PDL.

Why record pocket depths involving natural teeth. When the sulcular depth is chronically in excess of three millimetres, the ability for self cleansing may not be possible. Accumulation of both debris and microbes will eventually deteriorate periodontal health by destroying the junctional fibres of the periodontal ligament. This may lead to continual bone loss and eventual tooth loss. Therefore, pocket probing and depth documentation is a routine part of monitoring the health of the soft tissue around natural teeth. Once the aetiology of the problem has been identified, various treatments can then be utilized to restore the situation back to health.

Recording pocket depths involving natural teeth. The act of probing around natural teeth is not prone to iatrogenic complications. The supra-crestal soft tissue attachment around a tooth is comprised of epithelial and connective tissue. Hemidesmosomes connect the junctional epithelium to the tooth surface. Below the epithelial layer there are circular gingival fibres circulating the root. Additional fibres exist that run perpendicular to the tooth surface, and insert directly into the cementum layer. Hence, in a healthy state there is a secure attachment from the gingival complex to the tooth surface, which is not easily broken with the apical pressure of a periodontal probe. Puncture of this attachment would not only require significant apical pressure, but would also cause pain to the patient due to the presence of perforating neural tissue within the attachment. Accordingly, the patient's response to pain will allow the operator recording pocket depths to instinctively refrain from applying pressures sufficient to break the attachment.

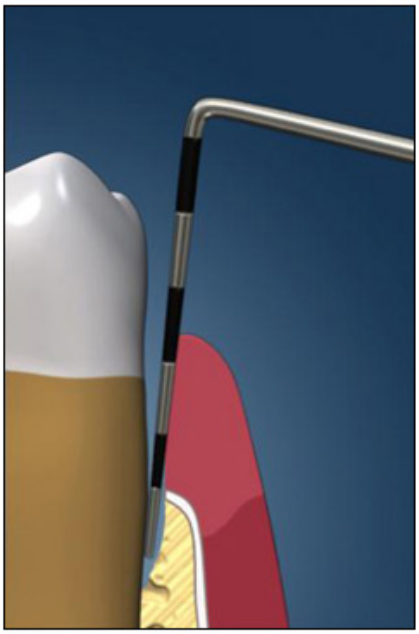
Figure 2. Probing the gingival sulcus around natural teeth.

Example of a healthy periodontal state



Example of probing a healthy state

Example of a healthy periodontal state

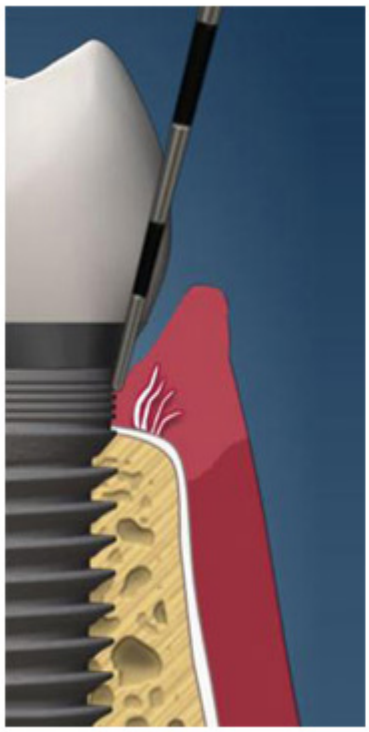


Eample of probing a periodontal pocket

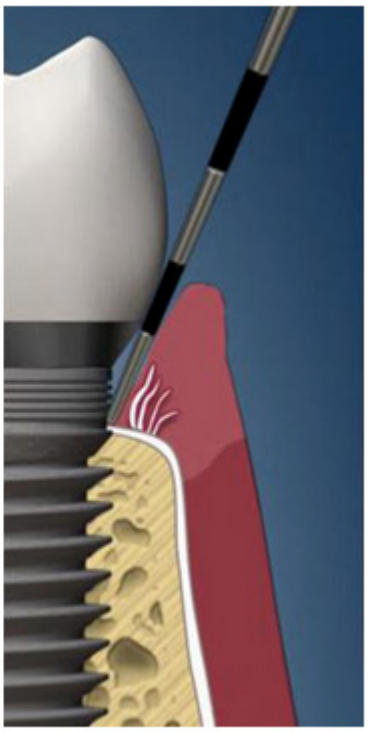
The peri-implant sulcus and gingival attachment. Recording pocket depths around dental implants cannot be performed in the same way as recording pocket depths around natural teeth.
Dental implants do not have a cementum layer covering the surface, and thus, a soft tissue attachment similar to natural teeth does not exist. **What exists instead is a peri-implant soft tissue seal.** In this

seal, the junctional epithelium still attaches to the implant surface via hemidesmosomes, but the gingival fibers do not insert into the implant.
Although collagen fibre bundles are present, they originate from the bone surfaces and run vertically and parallel to the implant surface (Berglundh 1991; Listgarten 1992).
Probing the peri-implantv sulcus. The gingival attachment to implants is much weaker and can easily be broken without significant pain to the patient. Operators who are used to probing around natural teeth may inadvertently and routinely probe beyond this weak attachment. Consequently, while routinely probing pocket depths around dental implants, the operator may inadvertently break the seal in 6 or more locations. The results of this are two-fold. The first being a greatly over-exaggerated pocket depth reading, and the second being the creation of passageways through which opportunistic bacteria can gain access to bone and propagate its loss.

Figure 3. Probing Dental Implants:



Example of a proper peri–implant probing



Example of a iatrogenic pseudopocket

Two problems may arise from peri-implant pocket recordings.

1. Increased pocket depth may be perceived as a disease state and unnecessary treatment may be prescribed.
2. Continual pocket evaluation may propagate the loss of bone around the implants through repeated attachment perforation facilitating bacterial re-contamination.

An experienced operator should be able to probe dental implants without continual perforation of the weak seal. However, if the operator is used to pocket evaluation of mostly natural teeth, he/she may not change his/her evaluation methods when probing dental implants, risking perforation.

Evaluating the health of a dental implant. If periodontal probing and pocket recording can lead to false readings and contribute to iatrogenic bone loss, then should pocket readings around implants be performed when no evidence of pathology exists? Although very gentle probing can be made without damaging the peri-implant seal, the act still serves little purpose. Unlike natural teeth, evaluating the health of a dental implant is not based primarily on pocket depths.

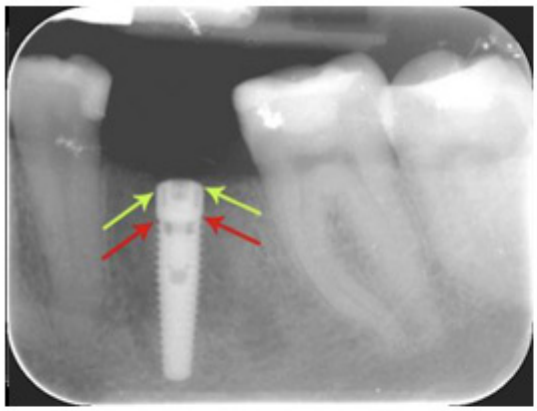
Figure 4. A pseudopocket around a dental implant.

If the operator is experienced and can probe around a dental implant without damage, they may be able to determine that there is a pocket around a dental implant that is greater than 3mm.

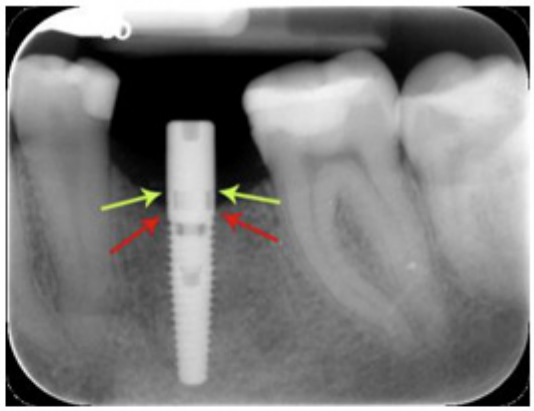
Why is there a pocket this deep and is any treatment necessary?
A 6mm pocket could be present because plaque has caused the tissue to inflame, generating an implant pseudopocket similar to the pseudo pockets seen around natural teeth. Alternately, this pocket may have been created purposefully when the implant fixture was placed. In the absence of plaque, bone loss, and associated inflammation, there is no need for any treatment. Calculus rarely forms sub gingivally on implants and vigorous scaling will not be of any benefit. (Ellen, 1998).

Bone loss.
The most critical evaluation of the health of a dental implant is the presence or absence of bone loss. In the first year some bone loss is acceptable with most implant systems. During this time, the peri-implant bone complex often resorbs to the first thread of the implant fixture. It is important to understand and remember that this is a common phenomenon and may not require any treatment.

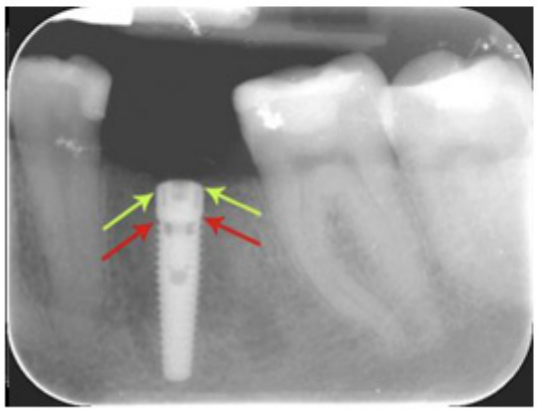
Figure 5. Radiograph documentation of peri-implant bone loss.



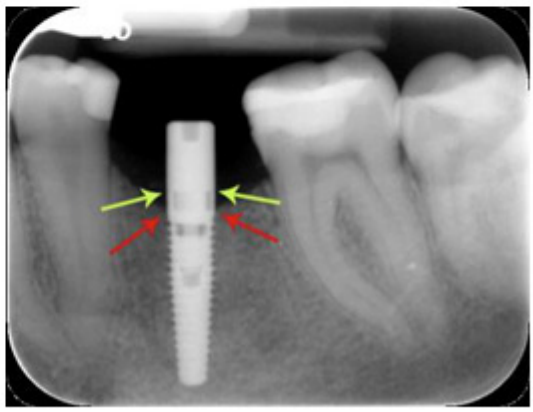
A. Radiograph of implant at time of insertion.



B. Follow-up radiograph (5 months) showing bone remodelling to the first thread



C. 1-Radiograph of implants at time of insertion.



C. 2-Follow up radiograph of implants 6 months after insertion.

Figure 5C-2. represents an example of obvious bone loss, and the patient should be referred to the appropriate specialist. Probing should be abstained as it is already clear that there is a problem. Since a hygienist or inexperienced general dentist will not be providing any treatment, probing will only exacerbate the situation.

Healthy vs. not healthy

In the opinion of this practitioner, if the implants are non mobile, if there is no bone loss past the first thread, and if there is no obvious tissue inflammation, **pocket recording would be considered contraindicated.**

Regardless of the pocket depth, if there is no inflammation and no bone loss there will be no treatment. Therefore, probing is futile and only risks the destruction of the weak peri-implant seal, which may potentiate bone loss and may create iatrogenic peri-implantitis.

Figure 6. Radiograph of implant with 6mm pocketing and bone loss to the first thread (4 years).

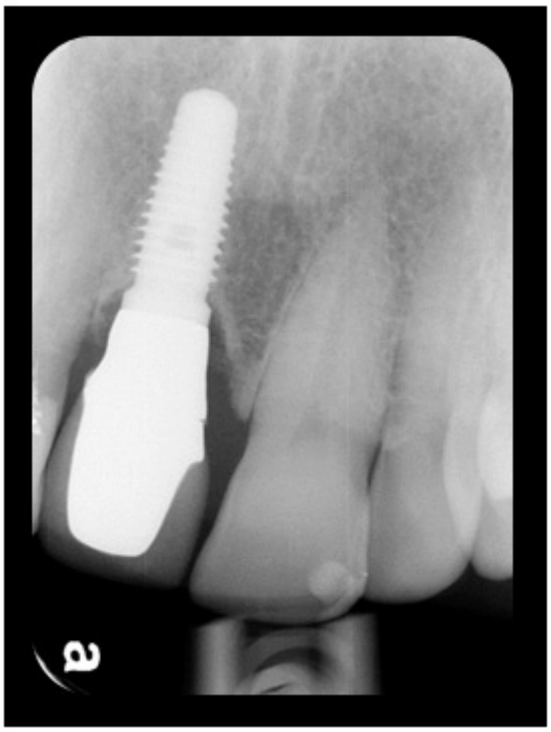


Figure 7. Clinical photos of implant in Figure 6 showing no inflammation and no symptoms.

A. Frontal View

B. Occlusal View

Inflammation

Inflammation is another critical factor that determines whether any treatment will be required. If there is inflammation, then the aetiology that is causing the inflammation needs to be addressed.

Although many reasons exist, the most common cause of inflammation around dental implants is due to excess cement that was not removed during crown cementation. Cement may remain even after meticulous attempts at removal, as is particularly true with deep sub-gingival margins. It may create inflammation even after dormant for many months even years.

In addition, ill-fitting supra-structures can create non-cleansable areas (large micro-gaps) that promote plaque accumulation and inflammation. Supra-structures that create chronic stress on the fixtures may also cause inflammation. Other factors that can lead to inflammation include the health of the patient and the absence of attached gingiva .

Bone Loss

Bone loss in the presence of inflammation makes for an easy diagnosis, but it is possible for bone loss to persist without inflammation, bleeding, or any other signs of disease. In these cases, the aetiology may be difficult to isolate and may in fact be a combination of more than one factor.

One major reason for bone loss is stress. For instance, if there are several implants splinted together by a bar or fixed prosthetics and the fit of the bar is not passive, then chronic stress is placed on the implants. In turn, stress on the implants may cause stress on the bone and result in continuous bone loss.

Another common reason for bone loss around implant fixtures is overload. Overload may be caused by not enough implant fixtures supporting a long span bridge or simply improper occlusal anatomy that causes excessive forces during mastication.

Furthermore, bone loss may be the result of **unsuccessful grafting procedures.** With Guided Tissue Regeneration techniques, an allograft is resorbed and replaced with the patients own bone by the body. If the area is too thin, has poor blood supply, or is infected, then the graft may resorb but will not be replaced with the patient's bone, thus causing a defect.

As illustrated in the aforementioned situations, there are many factors that may contribute to inflammation and bone loss around dental implants. The diagnosis of the aetiology of dental implant pathology is beyond the scope of the practice of a dental hygienist and possibly even a dentist who does not regularly experience dental implant cases.

Dental implant Maintenance and Recording. The purpose of the maintenance appointment should be to identify if there is a problem or potential problem that needs attention. A proper referral can be made with comprehensive recording and will greatly benefit with arriving at a correct diagnosis and treatment.

What to Record:

1. Presence or absence of inflammation /swelling

2. Bone level (tread count).– Stable . Acute, continuous.

3. Bleeding and/or Suppuration

4. Any supra-structure loosening

5. Any Occlusal changes.(ie. Loss of teeth, or new opposing crowns)

1) If there is **inflammation** and no bone loss: Check to see if there is any cement remaining at the margins or other rough stimulants. If found, remove cement/stimulant and monitor whether the inflammation disappears. If inflammation does not disappear after debridement : Refer to appropriate specialist and do not check pocketing. **Swelling** – Identify weather from dental implant area or adjacent teeth.

2) **Bone Level** ; Record how many treads are not covered by bone . With non treaded implants record in mm from a identifiable margin .

i) If there is bone loss after fixture placement and loss has been created to the first thread it is "**Remodelling**".

ii) If there is bone loss after prosthetic placement it is "**Initial**".

iii) If there is no change in bone height from the last evaluation it is "**Stable**".

iv) If there was no bone loss for one or more evaluations and now there is evidence of bone loss it is "**Acute**".

v) If there is bone loss on two or more evaluations in a row then it is "**Continuous**".

3) **Bleeding and/ or suppuration** . Record if bleeding is present and if Suppuration is present. Both are suggestive of pathology. Refer to appropriate specialist and do not check pocketing.

4) **Any supra structure loosening must be recorded**. This needs to be corrected as it will cause inflammation and bone loss..

5) Occlusal changes : record if there are any occlusal changes that may affect how much occlusal pressure is exerted on the implants.

i) Opposing occlusion Changes. If a new crown is made opposing the dental implant it made be in hyper occlusion and place undue pressure on the implants causing continuous bone loss.

ii) Loss of teeth. Loss of teeth may place additional stresses on the implant causing bone loss due to stress.

iii) New prosthetics. Removable prosthesis that may be attached to the implant may again place additional stress on the implant.

iv) Periodontal condition of surrounding teeth. If the surrounding teeth are periodontal involved with mobility ,this could change the occlusal load on the implants.

As demonstrated in the aforementioned examples, there is no reason to check for pocketing. In health, even deep pockets are acceptable and probing may only lead to iatrogenic inflammation and bone loss. Moreover, in disease states, the patient will be referred to an appropriate specialist and once again, probing is not necessary and may only complicate the diagnosis.

This is not to say that pocketing will not be a part of the diagnosis. Probing should be done by an operator that is experienced with evaluating dental implants .

What is important to document the above 5 conditions.

Proper radiographs can clearly show the bone level, and consequently, serve as a means to document whether the bone is stable (no change in height) or progressing over time. Changes in bone level height is useful when a referral is made. Therefore, yearly peri-apical radiographs of dental implant fixtures is recommended. Acute conditions usually are associated with swelling and suppuration.

Cleaning dental implants.

It cannot be emphasized enough that dental implants are not natural teeth, and require special care when professionally cleaned. There are three factors to consider when determining how to perform hygiene appointments for patients with dental implants.

Titanium fixtures will scratch easily. Scratches promote plaque and calculus accumulation, inflammation of the soft tissues, and bone loss around the implant fixtures. To decreases the possibility of scratching, the metal instruments used to clean dental implants should be softer than the titanium alloy that comprises the implant. Various scalers are made specifically for dental implants, which may be of carbon fibre, gold, or a variety of plastics.

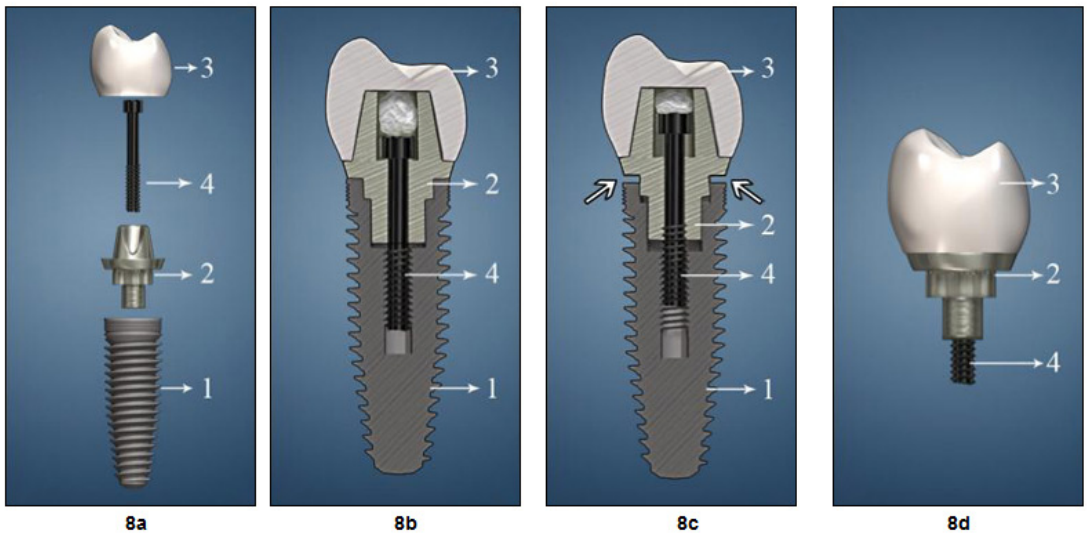
Cleaning an implant requires only gentle scaling and special attention to preserve the delicate peri-implant seal. Calculus rarely forms subgingivally on implants, and vigorous scaling will not be of benefit (Ellen, 1998). To finish, polishing with gauze is sufficient as opposed to using the prophy angle .

Using ultrasonic scalers. Regardless of claims by manufacturers, **no ultrasonic scalers may be used to clean dental implants and their prosthetics.** There are two main types of supra-structures that replace teeth in a non-removable fashion; screw retained and cemented. Both are disturbed by the use of ultrasonic scalers.

The cemented supra-structure. The dental implant complex is composed of an implant root fixture, a meso-structure (post and core), and a crown. The meso-structure is retained to implant fixture via a small screw, giving the implant a core upon which a traditional crown may be cemented.

Figure 8. Composition of the cemented supra-structure.

Implant root fixture (1). Meso-structure (2). Crown (3). Internal screw (4).



Ultrasonic scaling devices produce vibrations throughout the entire structure of the implant, eventually loosening the small screw anchoring the meso-structure (Figure 8c). This situation creates a complex problem. First, the meso-structure has a crown cemented on top of it, which prevents access to the screw and the possibility of tightening it. Second, the crown and meso-structure only loosen to the point where the screw reaches the upper limit of loosening, and not enough for the entire meso-structure and crown to separate from the implant fixture.

It is extremely difficult to remove the crown from the meso-structure even if it is only attached with temporary cement. Often the crown must be destroyed in order to allow access the meso-structure screw.

Some companies have designed ultrasonic scalers that have covers on their tips, a design justified to be safe for implants on the basis that these scalers do not scratch the implant. Even if the scaler does not scratch the metal, two problems still exist with these instruments.

1) Firstly, there is a greater possibility that the scaler will be inserted into the weak attachment and break the gingival implant seal because of the loss of tactile sensitivity by the operator which may cause bone loss.

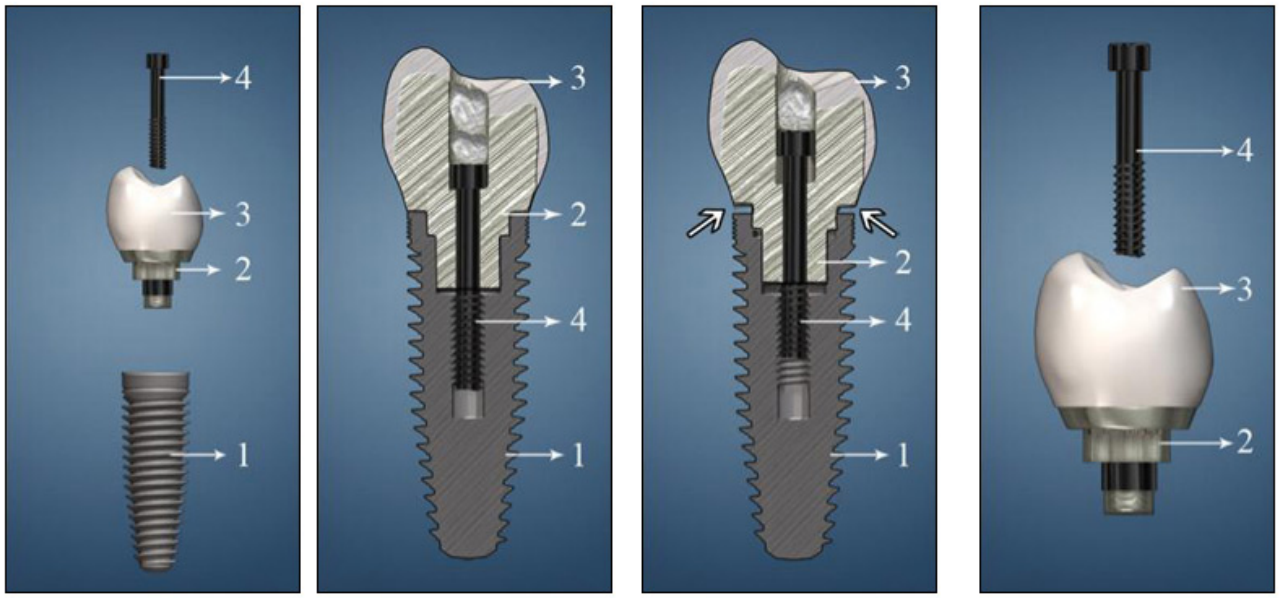
2) Secondly, the still existing vibrations from the ultrasonic scaler will increase the possibility that the meso-structure screw will loosen. The clinical result of this is a loose crown on the implant.

It is important to realize that the crown loosening may not be apparent during the hygiene appointment. Once the initial tight fit is broken, the crown will become more loose with time. As a result, the loose crown may not be noticed by the patient until a few days or even weeks after the hygiene appointment. Electric and especially ultrasonic toothbrushes will have the same effect as ultrasonic scalers, and hence, patients should be cautioned against these devices during home care discussions.

Screw retained crowns. In a screw retained crown, the crown is secured to the implant fixture by an internal screw that passes through the occlusal of the crown. The same reasons for crown loosening apply to screw retained crowns as they do to cemented crowns. What differs, however, is that if the internal screw becomes loose, it is still possible to access and tighten this screw through the original opening in the crown, avoiding the need to destroy the crown. Despite this advantage, screw retained crowns do loosen at a much higher frequency than cemented crowns.

Figure 9. Composition of a screw-retained crown.

Implant fixture (1).meso structure as part of the crown 2). Crown with opening? (3). Internal screw (4).



Treating a loose crown on an implant. It is naïve to believe that waiting for the crown to further loosen will make its removal from the implant fixture easier. As described earlier, the screw has a finite area to which it can loosen, which prevents the crown from being removed. Instead, as the gap between the crown and the implant fixture grows, more bacteria and debris will accumulate leading to halitosis inflammation and even bone loss.
Crown loosening should also be documented during dental implant maintenance appointments. When a loose crown is identified, it must be corrected. There are various ways to do this, which are beyond the scope of this article.

Conclusion. The purpose of this article was to explain why dental implants and their prosthetics require special attention, and to highlight their need of different maintenance protocols from natural teeth. There are several items that should be documented during the maintenance appointment and some things that should not be done.
Whereas measuring pocked depths around natural teeth have a purpose and are a routine procedure for natural tooth maintenance, pocket measurements involving dental implants should be avoided and rarely serve a purpose. Moreover, ultrasonic scalers should never be used and particular attention should always be paid to the weak seal between the gingiva and the implant during implant fixture plaque and calculus removal.

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Ellen RP. 1998. Microbial Colonization of the peri-implant environment and its relevance to long term success of osseointegrated implants. 1998. Int J Prosthodont. 11:433-441

If you have any questions or comments, please email me at drpulec@consult-pro.com