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Review Article

IMPLANT SUCCESS AND FAILURE

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ABSTRACT

The answer to the question of what constitutes success in implant dentistry remains complex. There is no unanimous definition of clinical success for implants or teeth. Teeth and implants do not permit a strict diagnosis of total health or failure. A tooth with periodontal pocket depths of 5mm may need therapy but is still within a range of "success". Failure is often easier to describe; but if a dental unit does not qualify as failure, it does not necessarily qualify as a success.

Keywords: Dental implants, Bone loss, Periimplantitis, Pocket depth, Implant success.

INTRODUCTION

Dental implants do not decay and do not have dental pulps that may give indications of symptoms or disease; thus periodontal indices are often used for evaluation of implant success. However, classification of periodontal disease and the terms used to describe these dental conditions become controversial when applied to implants. As the causative factors, pathogenesis, and host factors become better understood, the descriptions of the tooth-or implant-related diseases evolve.

Natural Tooth Conditions

The American Academy of Periodontology has defined five periodontal case types for diagnosis and treatment. These categories of disease do not indicate success or failure, but a range of health to disease.

Ideal clinical conditions for natural teeth include many factors, several of which apply to dental implants:Absence of pain, Less than 0.1mm initial horizontal mobility under lateral forces less than 100g, Less than 0.15 mm secondary mobility with lateral forces of 500g, Absence of observed vertical mobility, Optimal probing depths of less than 2.5mm,Radiographic crestal bone height 1.5 to 2.0mm within the cemento-enamel junction ,Intact lamina dura, Papilla bleeding index of grade 0 to 1 with no exudates and Absence of recession and furcation involvement on multirooted teeth[1].

Implant Failure:

Failure rates may be included "failed" as well as "failing" ("ailing"). Implants, the two categories should be listed separately. From practical standpoint, implant failures can be grouped into "early" failures, primarily the result of surgical and/or postoperative complications, and "late" failures that arise during and following the restorative phase.

An implant diagnosed as a clinical failure is easier to describe than one which is a success. Horizontal mobility beyond 1mm or any clinically observed vertical movement under less than 500gm force, rapid progressive bone loss regardless of the stress reduction and peri-implant therapy, or pain during percussion or function indicate failure and the need for implant removal. Whether the implant remains in the mouth or not the implant has failed.

The American Dental Association Council on Dental materials, instruments and equipments states that consideration should be given to the evaluation-Durability, Bone loss, Gingival health, Pocket depth, Effect on adjacent teeth, Function, Esthetics, Presence of infection, discomfort, parasthesia or anesthesia, Intrusion on the mandibular canal, patient emotional and psychological attitude and satisfaction.[2]

The success criteria, the Albrektsson report was specific for implants with rigid fixation and is widely used today.

Criteria for Implant Success:

- An individual, unattached implant is immobile when tested clinically.
- A radiograph does not demonstrate any evidence of peri-implant radiolucency

- Vertical bone loss is less than 0.2 mm annually following the implants first year of service.
- Individual implant performance is characterized by an absence of persistent and/or irreversible signs and symptoms such as pain, infections, neuropathies, paraesthesia, or violation of the mandibular canal.

The Criteria with some modification include:- Pain, Rigid fixation, Percussion, Bone loss, Radiographic evaluation, Peri-implant disease, Probing depth, Bleeding index.

A comparison of natural teeth and implants for each criterion provides an insight into their differences in the health-diseases continuum.[3]

Pain

Absence of pain under vertical or horizontal forces is a primary implant criterion of evaluation. Usually (but not always) pain does not occur unless the implant is mobile. The presence of pain almost always requires removal of the implant, even in the absence of mobility. The condition rarely improves.

A natural tooth becomes hyperemic and cold temperature-sensitive as a first indicator of a problem; this warning sign does not exist with an implant. A tooth with a more serious condition becomes sensitive to heat and tender to palpation, indicating pulpitis. The implant is almost never temperature sensitive, but may become tender to percussion. Tenderness signifies a more advanced stage of complication for an implant than for a tooth, because it, usually implies stress beyond physiologic limits rather than conditions that can be treated with endodontic therapy. Implant tenderness may have a successful treatment. Because this condition is usually related to excess force in amount and/or duration, treatment consists of the elimination of as much stress on the prosthesis as possible for 2 or more weeks. A major advantage of implant overdentures is that the restoration may be removed during sleep, at times when parafunction may occur, or when any tenderness develops. The occlusion and parafunctional habits should especially be addressed with implant sensitivity. The prosthesis most often should be modified, or additional implants should be placed to dissipate the forces[4].

Rigid Fixation:

All implant abutment supports discussed in this book aim at rigid fixation as the clinical goal. Rigid fixation indicates an absence of clinical modality of an implant under 1 to 500g vertical or horizontal forces. It does not guarantee a direct bone-implant interface. However, when clinically observed, rigid fixation usually means that at least a portion of the implant is in direct contact with bone, although the percentage of bone contact cannot be indicated. Steflik and associates found that a lack of clinical mobility did not correlate with the presence or absence of fibrous connective tissue around an implant body[5].

Implants with less than 0.5mm horizontal movement may return to rigid fixation and zero mobility. This condition is unlikely, but has been observed by the author on occasion. A tooth with primary occlusal trauma shows an increase in mobility and periodontal ligament space, illustrated by a thickening in the lamina dura on radiographic study. Once the cause of trauma is eliminated, the tooth may return to zero clinical mobility and a normal radiographic appearance. This condition is not as predictable around an implant. However, the chances improve if no mobility was noted initially. If the prosthesis has already been delivered to the patient, little is lost if most forces are removed from the implant for approximately 2 months before final evaluation. A horizontally mobile implant prior to placement into function has much less chance of improving, and removal is indicated. Vertical mobility of an implant warrants removal.[6] An implant with greater than 1mm horizontal mobility or any vertical mobility should not remain in function, to avoid continued bone loss and a further compromised implant site. The Periotest is a computer-mechanical device that measures the damping effect against objects. A soft surface or mobile object will give higher recordings than a hard and/or rigid object. The recordings range from negative to positive numbers. Teeth with clinical zero mobility have typical ranges around 5. A nonmobile implant most often ranges from - 6 to 0. This device may be used to evaluate slight changes in implant rigid fixation or note prostheses that becomes partially retained.

Percussion

Percussion is neither an indicator of clinical health nor of the state of rigid fixation. The "ringing" sound that occurs on percussion corresponds to the presence of "some" bone at the interface, in as much as 2mm of bone and 16mm of bone-implant interface sound almost identical.[7]

Bone Loss

The level of the crestal bone around an endosteal implant should be compared to the initial placement position of the implant. An implant originally placed 2 mm above the bone and another countersunk 2 mm below the bone cannot use the same implant reference point for judging bone loss. The probing depth may evaluate bone loss more accurately than radiographs. All sides of the implant may be evaluated. The probe is more likely to reach the crestal bone with an implant than around a tooth, because a weak hemidesmosome loose attachment is present between the implant and soft tissue above the bone.

Under ideal conditions, a tooth or implant should lose minimum bone. However, it is not possible to determine precisely how much bone loss indicates success or failure. An 18-mm-high root form placed in very soft density D-4 narrow crestal bone may lose 5mm of bone before the bone density improves and long-term stability occurs, yet the implant may still be considered successful. On the other hand, a 7-mm-high root form may be placed in dense bone and lose the same 5mm of bone support and indicate failure. In general, if more than one third of the implant height has lost crestal bony contact, the implant is at significant risk, regardless of the original amount of implant-bone contact[8].

The initial bone loss around an implant during the first few years is almost always a result of excessive stress at the crestal implant-bone interface. Stress factors such as occlusal forces, cantilever length, and especially parafunction should be evaluated and reduced when initial bone loss is observed.

Radiographic Evaluation:

Radiographic interpretation is a most difficult way of assessing implant health, but often in used as an early indictor of clinical problems. The crestal bone region is usually the

most useful diagnostic tool in determination of a healthy implant. Crestal bone loss is used primarily to determine the need for initial preventive therapy. Early loss of crestal bone is usually a result fo stress at the permucosal site. A radiograph only illustrates the mesial and distal crestal levels of bone. Early bone loss most often occurs on the facial aspect of the implant. The radiographic height of bone represented usually is the higher, thicker lingual or palatal plate of bone, whereas the actual crestal bone usually slants toward the facial aspect in an inferior direction[9].

An absence of radiolucency around an implant does not mean bone is present at the interface, especially in the anterior mandible. As much as 40% decrease in trabecular bone is necessary to produce a radiologically evident difference in this region, because of the dense cortical bone. However, the presence of a radiolucent region around an implant definitely represents the presence of fibrous tissue, although the amount cannot be determined precisely. It usually is greater than the radiolucent zone next to the implant.

Parallel periapical radiographs are more difficult to obtain for implants than teeth. The implant is often placed in bone inferior to the apex of the preexisting natural tooth. As a result, the inferior portion of the implant often is located below muscle attachments or in regions almost impossible to record with a parallel radiographic method. A foreshortened or elongated image compromises the radiographic interpretation of the crestal bone[10].

Peri-Implant Disease:

Gingivitis is a pathologic process involving the region of the soft tissue above the crest of bone. It can be (1) associated, (2) acute necrotizing, (3) ulcerative, (4) hormonal, (5) drug-induced, or (6) spontaneously occurring. These categories should also relate to the gingiva around an implant, because the mode of attachment of gingiva to a tooth or implant have been reported to be similar.

An exudate indicates a peri-implantitis and consequent bone loss. The reduced amount of bone may in turn lead to secondary occlusal trauma. Therefore, stress criteria need to be evaluated and causative elements eliminated. In addition, short-term antibiotic treatment, use of chlorhexidine, and aggressive professional and patient care of the soft tissue is indicated. An exudate persisting for more than 1 to 2 weeks usually warrants force reduction and surgical management of the condition[11].

Probing Depths:

Stable rigid fixated implants have reported pocket depths of 2 to 6 mm. Partially edentulous patients have consistently greater probing depths around implants than around teeth. A probing depth less than 3mm is a criterion of health for a natural tooth but provides less diagnostic information for an implant, especially in the maxilla where the increased thickness of the soft tissue is variable before implant placement. A tissue thickness of 5mm results with an initial 5-mm implant sulcus, unless gingiplasty is performed. However, implant sulcus depths of 6mm or more provide an environment favorable to gram-negative microorganisms and gingival inflammation, which favors loss of bone. There is a direct relationship between probing depth and oxygen tension and the effect of the latter on subgingival microflora. Therefore, the tissue thickness and implant sulcus depth should be reduced to an ideal 3 mm or less sulcular depth when esthetics are not a primary concern. Gingivoplasty to reduce pocket depth may be performed at the initial surgery, the uncovery surgery after initial healing, or before the final prosthetic impression. However, thinning the flap at initial surgery may permit greater loading of the implant body from an overlying soft tissue-borne restoration[12].

An increasing probing depth is more of a diagnostic criterion because it usually signifies bone loss, except in case of gingival hyperplasia or hypertrophy. The location of the probe tip subgingivally depends on the pressure used, the presence of inflammation, and the angle at which the probe is introduced next to the junctional epithelium or crest of the bone. A heavy pressure will reach the crestal bone or beyond. A positive co-relation has been demonstrated between pocket depth, gingivitis, and higher plaque distribution. However, this observation was not correlated with accelerated marginal bone loss, microflora, or histologic changes indicative of periodontitis. The benefit of probing the implant sulcus is challenged in the literature because of lack of sound scientific criteria. There is potential damage to the fragile attachment or marring of the implant surface.

A primary factor in the accuracy of probing depth is the angle at which the probe is introduced into the sulcus. Because an implant is only 4mm in diameter, a fixed prosthesis if often contoured so that parallel probing access is not possible along the abutment. Plate form implants have undercut regions, especially on the buccal and lingual of the abutment. The probe cannot enter the region of the implant neck with any diagnostic certainty.

In spite of all the limitations, the author believes that charting the attachment level in implant permucosal areas does aid the clinician in monitoring these regions. Probing using fixed reference points on the abutment allows evaluation of crestal bone loss, especially during the first critical year of stress accommodation of the bone. Changes in crestal bone levels warrant close evaluation and early treatment. Occlusal adjustments, patient education to reduce stress on the implant system, use of parafunctional appliances, and other stress-reducing methods are required when crestal bone loss is noted[13].

Probing also will reveal tissue consistency, bleeding, and exudate. Care should be taken not to inoculate the implant sulcus with bacteria from a diseased periodontal site. Plastic probes are available to prevent scratching of the implant surface. Despite the uncertain meaning of pocket depth, it is an easy and quick method for assessing potential deleterious changes in the peri-implant environment and should be performed every 3 to 4 months for 1 year after the procedure. After this time, if crestal bone levels are stable, probing may be restricted to suspicious regions where bone loss is radiographically observed.

Bleeding Index:

A bleeding index is an indicator of sulcus health. Implant success is not so related to gingival health as in the natural tooth. The inflammation may be limited to above the bone, because there is less fibrous tissue between the implant and bone interface. The most common sulcus bleeding gingival

index used for implants is the Loe and Silness Gingival Index (GI). The GI scores the gingival inflammation on the facial, lingual, and mesial surface of all implants. The distal surface may be added if the implants are more than 2 mm apart. Easily ulcerated sulcular epithelium, reflecting inflammation, and poor oral hygiene are primary causes of bleeding on probing. Bleeding can be provoked by undue force of the probe. When the sulcus depth is less than 5mm and the bleeding index increases, chlorhexidine often is indicated, along with other professional and home care methods. Bleeding on probing with sulcus depths in excess of 5 to 6 mm is more common and usually requires reentry surgery. Radiographic bone loss and increased pocket depth have been correlated with bleeding. During first year clinical examinations of the peri-implant gingival tissues, bleeding on probing, and poor color, form, and consistency should be recorded, even if removal of the restoration is needed. After 1 year of stable probing depths, the examination may be restricted to spot checks at maintenance appointments. Removal of the prosthesis for evaluation is not indicated unless changing conditions warrant. Repeated removal of the prosthesis will wear the attachment system and cause more frequent partially retained restorations over the long-term[14].

Implant Failure:

An implant diagnosed as a clinical failure is easier to describe than one which is a "success". Horizontal mobility beyond 1mm or any clinical observed vertical movement under less than 500-g force, rapid progressive bone loss regardless of the stress reduction and peri-implant therapy, or pain during percussion or function indicate failure and the need for implant removal. Whether the implant remains in the mouth or not, the implant has failed.

When in doubt, the implant is treated similar to a natural tooth presenting the same conditions. Implementation of aggressive implant maintenance treatment is warranted with horizontal mobility of less than 1mm, exudate, a pocket depth of 5mm and increasing, a bleeding index 2 or above, or slight tenderness to percussion or function. The mobile implant is in greater need of treatment than natural teeth, whereas an implant with greater than 5mm pocket depth may be stable, with further treatment not indicated[15].

The ultimate decision of implant "success" lies with the practicing dentist rendering continued dental therapy for the patient. A single tooth implant with 1mm mobility is less at risk than a 12-unit fixed prosthesis implant abutment with 0.5-mm mobility. A "gray scale" of decision making exists, and absolute rules make for easy decisions, but not necessarily the correct ones for all patients[16].

CONCLUSION

Although the teeth in a day's time protocol require considerable sophistication in according the questions of the prosthodontic team, it offers patients a number of significant advantages, compared to traditional implant-placement protocols. The number of office visits required is minimal.

Patients who have to travel long distances to undergo fixed prosthodontic rehabilitation particularly benefit from the condensed treatment time. Furthermore, this approach virtually eliminates post-surgical discomfort while offering an almost instantaneous improvement in speech and masticatory function, esthetics, and patients self-image. The overall dental experience becomes a positive one helping to counterbalance the negative histories that so often create the dental phobias that lead to dental deterioration.

Appropriate patient selection remains critical candidates for this procedure must have a sufficient quality and quantity of bone in order to ensure initial fixation. They also need to be conscientious about following all post-surgical instructions where these elements are present, however, the teeth in a day, time protocol holds the promise of significantly expanding the number of individuals who are willing and able to reap the rewards of implant dentistry.

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