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Short Review

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Implant mobility: Revisited

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Abstract

The success lies in achieving and maintaining the stability of a dental implant. However, implant failures are common and among them the most serious issue is the implant mobility. This paper reviews on the implant mobility, its causes, methods to detect mobility and also possible treatment approaches.

Keywords: implant; implant failure; implant mobility; osseointegration.

Introduction

Dentistry has witnessed several changes in the past quarter century. Now that its scientific foundations have been laid, this branch of reconstructive dentistry has passed out of the phase of mere empiricism and sheer wishful thinking. Though the success rates reported with this form of therapy are relatively high, failures do occur. Hence, a thorough knowledge regarding the various aspects of failure is deemed necessary [1]. The longitudinal clinical studies have reported a success rate at 10 years ranging from 81% to 85%, for the maxilla and from 98% to 99% for the anterior mandible [2].

Esposito et al, 1998 have listed out the various criteria for success which were agreed upon at the 1st European Workshop on Periodontology. According to them absence of mobility, average radiographic marginal bone loss of less than 1.5 mm during the first year of function and less than 0.2 mm annually thereafter, absence of pain or parasthesia were to be considered success criteria for osseointegrated implants [3].

The most common diagnostic criteria employed for the evaluation of established implant failures (failed implants) are as follows: [1].

1. Clinical signs of early infection: During the healing period (3−9 months) complications such as swelling, fistulas, suppuration, early/late mucosal dehiscences, and oseteomyelitis, can occasionally be present and may indicate implant failure.
2. Pain or sensitivity
3. Clinical mobility
4. Radiographic signs of failure
5. Dull sound at percussion

Successful osseointegration is a prerequisite for functional dental implants, and primary implant stability is a prerequisite for successful osseointegration [4]. Rigid fixation describes the absence of clinical mobility in vertical or horizontal forces within 500 g. Osseointegration defines the surrounding bone that is in direct contact with an implant surface [5]. Over the years, rigid fixation and osseointegration have been used interchangeably. Today, the term "lack of mobility" may be used to describe implant movement, and is a clinical condition most often used to determine as to whether the implant is integrated.

Even an osseointegrated implant may move less than 75 m but appears clinically as zero mobility [6]. Clinical lack of implant mobility does not always coincide with a direct bone–implant interface [7]. However, when observed clinically, lack of mobility usually means that at least a portion of the implant is in direct contact with bone, although the percentage of bone contact cannot be specified [8]. This paper reviews on the implant mobility, its causes, methods to detect mobility and also possible treatment approaches.

Causes of mobility

Implant mobility can be observed either at the time of implant placement or after few months or years of implant placement. The reasons for this have been described in table 1.

Methods to detect mobility: Historically, the gold standard method used to evaluate the degree of osseointegration was microscopic or histologic analysis [9].

However, due to the invasiveness of this method and related ethical issues, various other methods of analysis have been proposed which includes use of blunt ended instruments, radiographs, cutting torque resistance, reverse torque and resonance frequency analysis (RFA). Table 2 describes the various methods of detecting implant mobility.

Treatment

In case of a loose dental implant, the only treatment is to immediately remove all components of the implant to avoid the progressive destruction of the surrounding tissues. Removal of the implant may vary according to the implant system and design. Granulation tissue, if any, should be carefully removed before further treatment [10]. The implant can then be reimplanted in adjunct to Guided bone Regeneration which is a routinely applied method in dental implantology.

Surface modifications of Ti implants using oxidation, acid-etching, sand-blasting, ion implantation, laser ablation, surface coating with calcium phosphate, etc improves osseointegration. These methods alter the energy, charge and composition of the existing surface, but can lead to surfaces with modified roughness and morphology. Inorganic materials, such as the bioreactive calcium phosphate (CaP) coatings (or HA), have been extensively applied because of their chemical similarity to bone minerals. Several studies have shown that these coatings achieve a very intimate contact between the implant and bone [11,12]. Numerous different biologically functional molecules can be immobilized onto Ti surfaces to enhance bone regeneration at the interface of implant devices. The most promising candidates for osteogenic agents are the members of the transforming growth factor-β (TGF-β) superfamily, such as bone morphogenic proteins (BMPs).Others include polyelectrolyte (PE) multilayer (ML) surface modification involving the alternating adsorption of poly-cations (poly-L-lysine (PLL)) and poly-anions (poly- L-glutamic acid (PGA)) from aqueous solution onto a charged, solid surface.

Apart from all this, proper implant maintenance should be taken care by all the patients for the survival of the implant. Both at home and professional implant care have been summarized in (Table 1) [13].

Table 1: Summary of implant maintenance

At-home implant care	Professional hygiene care
Brushing	
Soft manual toothbrush	Scaling and curettage
Motorized tooth brush/power brush	Plastic instruments
Automated/sonic tooth brush	Plastic instruments reinforced with graphite
End-tufted brush	Gold-plated curettes
Tapered rotary brush	Ultrasonic or sonic scaler covered with a plastic sleeve
Interproximal/cirumferential cleaning:	
(i) Floss	
Plastic floss	Polishing
Braided flossing cord	(i) Rubber cup with a nonabrasive polishing paste
Satin floss	Such as aluminum oxide, tin oxide, APF-free prophy paste, and
Woven floss	low-abrasive dentifrice
Yarns dental tapes	(ii) Air polishing
(ii) Interproximal cleaners	(Use remains controversial)
Foam tips	
Interproximal brushes with a plastic coated wire	
Disposable wooden picks	
Locally applied chemotherapeutics For example: chlorhexidine digluconate (0.12%), plant alkaloids, or phenolic agents	*Locally applied chemotherapeutics* Such as Arestin, Atridox, PerioChip, or Dentomycin
Water irrigation For example: Hydro Floss	*Subgingival irrigation* Antiseptic agents such as Peroxide, Listerine, or Chlorhexidine using a plastic irrigation tip

Adapted from Gulati M, Govila V, Anand V, Anand B. Implant Maintenance: A Clinical Update. Int Sch Res Notices. 2014 [14].

Table 2: Reasons for implant mobility.

At the time of placement	After few months or years
• Implants placed in cortical bone had less bone-to-implant contact than the implants placed in cancellous bone, • Implants placed in posterior jaw locations were more frequently mobile than those placed in anterior jaw regions. • Quality 4 bone was associated with the highest rate of mobility while Q-2 bone, the lowest percentage of mobility. • The use of a bone tap associated with higher risk of making implant mobile [14].	• Absence of micro movement or movements within limits at the interface between bone and implant during healing is necessary for osseointegration to occur [15,16].

Table 3: Methods to detect implant mobility.

Test	Method	Advantage	Disadvantage
Clinical perception	With blunt ended instruments.	unreliable and nonobjective method.	Tapered root formed implants have a firm stop thereby giving false perception of stability [17].
Percussion test	Tapping against an implant carrier using a mirror handle and have to check on a ringing sound from an implant as an indicator of good stability.	Easy to perform.	Depends on the clinician's experince level and hence cannot be used as a standardized testing method [18].
Reverse torque test	Implants that rotates on reverse torque are considered failures and are then removed.	Assesses the secondary stability of the implant.	Chances of fracture are more during the osseointegration stage [19,20].
Cutting torque resistance analysis	The energy required for a current-fed electric motor in cutting off a unit volume of bone during implant surgery is measured and this energy correlates to bone density which determines the implant stability.	Provide useful information in determining an optimal healing period in a given arch location with a certain bone quality [5].	Can only be used during the surgery and not as a diagnostic aid. Doesn't assess the secondary stability [21].
Insertion torque measurement	Measures the bone quality during implant placement.	Used as an independent stability measurement.	Cannot collect longitudinal data to assess implant stability change after placement [22,23].
Periotest	It is an electrically driven device which percusses the implant to measure the stability.	Easy to use and understand.	Difficult to use in posterior regions. Measurements can vary depending on the direction and position of application. Cannot be used when the implant is under osseointegration." [4]
Pulsed oscillation waveform	Monitors the mechanical vibrational characteristics of the implant bone interface using forced excitation of a steady-state wave and the resonance and vibration generated are picked up and displayed on an oscilloscope screen.	It is used for in vitro and experimental studies.	Sensitivity of the test depends on the load direction and position [24].
Resonance frequency analysis	The electrical and the magnetic method uses connection wire and magnetic frequencies respectively to stimulate the implant/transducer complex and helps in detecting the stability.	Provides baseline reading for future comparison and postsurgical placement of the implant.	The transducer measure only 60 measurements and hence making it an expensive choice.[4]
Imaging techniques	Assess both quantity and quality of the jawbone [10].	Determines the health of the implant by estimating the crestal bone loss, which is a consequence of the osseointegration process.	Making an accurate, independent assessment of implant stability is not possible. Conventional periapical or panoramic views do not provide information on a facial bone level, and bone loss at this level precedes mesiodistal bone loss [24].

Conclusion

Predicting the success of implant and advising proper maintenance care lies in the hands of a clinician. Appropriate case selection that is suitable for surgical as well a prosthetic circumstances reduces the clinical challenges. The ability to detect Osseo integration and the survival rate of an implant is a valuable tool in the implant dentistry.

References

1. Prashanti E, Sajjan S, Reddy JM. Failures in implants. Indian J Dent Res. 2011; 22: 446-53.
2. El Askary AS, Meffert RM, Griffin T. Why do dental implants fail? (part I) Implant Dent 1999; 8: 173-85.
3. Esposito M, Hirsch JM, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants (I) success Criteria and Epidemiology. Eur J Oral Sci 1998; 106: 527-51.
4. Mistry G, Shetty O, Shetty S, Singh RD. Measuring implant stability: A review of different methods. J Dent Implant 2014; 4: 165-9.
5. Adell R, Lekholm U, Rockler B, et al. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg. 1981; 10: 387-416.
6. Reddy BV, Tanneeru S. Impact of chronic infections (periodontic and endodontic) in implant dentistry. J Int Clin Dent Res Organ 2015; 7: 65-72.
7. McKinney RV, Koth DC, Steflik DE. Clinical standards for dental implants. In: Clark JW, ed. Clinical Dentistry. Harperstown, PA: Harper & Row. 1984: 27-41.
8. Steflik DE, Koth DC, McKinney RV Jr. Human clinical trials with the single crystal sapphire endosteal dental implant: Three year results, statistical analysis, and validation of an evaluation protocol. J Oral Implantol. 1987; 13: 39-53.

9. Atsumi M, Park SH, Wang HL. Methods used to assess implant stability: Current status. Int J Oral Maxillofac Implants 2007; 22: 743-54.

10. Srivastava A, Afrashtehfar KI, Esfandiari S. How to manage a loosened dental implant associated with pain?.J Can Dent Assoc. 2014; 80: e46.

11. Sun L, Berndt CC, Gross KA, Kucuk A: Material fundamentals and clinical performance of plasmasprayed hydroxyapatite coatings: a review. J Biomed Mater Res. 2001; 58: 570-592.

12. Rohanizadeh R, LeGeros RZ, Harsono M, Bendavid A. Adherent apatite coating on titanium substrate using chemical deposition. J Biomed Mater Res A. 2005; 72: 428-438.

13. Gulati M, Govila V, Anand V and Anand B.Implant maintainance: a clinical update. International Scholarly Research Notices. 2014; 2014.

14. Orenstein IH, Tarnow DP, Morris HF, Ochi S. Factors affecting implant mobility at placement and integration of mobile implants at uncovering. J Periodontol. 1998; 69: 1404-1412.

15. Albrektsson T, Sennerby L. Direct bone anchorage of oral implants: Clinical and experimental considerations of the concept of osseointegration. Int J Prosthodontics 1990; 3: 30-41.

16. Pilliar RM, Lee JM, Maniatopoulos C. Observation on the effect of movement on bone ingrowth into porous-surfaced implants. Clin Orthop Rei Res. 1986; 208: 108-113.

17. Sennerby L, Meredith N. Implant stability measurements using resonance frequency analysis: Biological and biomechanical aspects and clinical implications. Periodontol 2000 2008; 47: 51-66.

18. Bayarchimeg D, Namgoong H, Kim BK, Kim MD, Kim S, Kim TI, et al.Evaluation of the correlation between insertion torque and primary stability of dental implants using a block bone test. J Periodontal Implant Sci. 2013; 43: 30-6.

19. Sullivan DY, Sherwood RL, Collins TA, Krogh PH. The reverse-torque test: A clinical report. Int J Oral Maxillofac Implants 1996; 11: 179-85.

20. Ivanoff CJ, Sennerby L, Lekholm U. Reintegration of mobilized titanium implants. An experimental study in rabbit tibia. Int J Oral Maxillofac Surg. 1997; 26: 310-5.

21. Nedir R, Bischof M, Szmukler-Moncler S, Bernard JP, Samson J. Predicting osseointegration by means of implant primary stability. Clin Oral Implants Res 2004; 15: 520-8.

22. Irinakis T, Wiebe C. Initial torque stability of a new bone condensing dental implant. A cohort study of 140 consecutively placed implants. J Oral Implantol. 2009; 35: 277-82.

23. O'Sullivan D, Sennerby L, Jagger D, Meredith N. A comparison of two methods of enhancing implant primary stability. Clin Implant Dent Relat Res. 2004; 6: 48-57.

24. Kaneko T. Pulsed oscillation technique for assessing the mechanical state of the dental implant bone interface. Biomaterials. 1991; 12: 555-560.