Hussaini, Dent Health Curr Res 2016, 2:3
http://dx.doi.org/10.4172/2470-0886.1000118

Dental Health: Current Research

Case Report

A SCITECHNOL JOURNAL

Long-Term Efficacy of Occlusal Loading on an Implant with Low Stability: A Case Report

Souheil Hussaini*

Abstract

Primary stability plays an important role in successful ossteointegration. Primary stability is defined as the contact of implant and bone during the surgical implant placement. This contact is crucial for direct bone deposition between the bone/implant interface as well as subsequent mineralization process of ossteogenesis. Secondary stability, however, is not purely a mechanical stability of the implant, unlike the primary stability; it is a biological stability which is formed within few weeks after implant placement during bone remodeling. This case report demonstrates that the secondary stability can be controlled by progressive loading and it dictates the percentage of functionally and biologically integrated bone-implant contact which in turn dictates its loading schedule.

Materials and methods: 5.8×9 mm Biohorizon implant was placed in the upper right 1st molar area. The patient was unable to attend the following visit for uncovery and restoration for a period of 3 years, however, upon uncovery the ISQ readings were 20. A provisional crown on the implant was made using a light cured zirconium silicate micro ceramic indirect restoration called Ceramage which was kept 3 mm out of occlusion. The occlusion was adjusted periodically till the ISQ value reached above 65 indicating its safety for loading. Results: the ISQ value increased from 20 to 77 over a period of 6 months with periodic occlusal adjustments resulting from progressive loading.

Discussion: Rather than diagnosing the implant in the category of failed implant it was decided to load the implant progressively below occlusion and improve its stability.

Conclusion: Placing the implant with low ISQ value on controlled progressive loading protocol in 6 months can improve the stability and ISQ value of the implant.

Keywords

Primary stability; Bone density; Insertion torque; Resonance frequency analysis; Biomechanical assessment

Aim and Objective of the Article

To demonstrate the effect of sequential implant loading with low ISQ value (unable to load) on its increasing stability over time.

Introduction

Implant stability plays a critical role in successful Osseointegration, which is viewed as a direct structural and functional connection between bone surface and surface of the load carrying implant [1-7]. Primary stability of an implant consists of a mechanical attachment between the implant and the cortical bone3. Primary stability is directly related to the quantity and quality of the supporting bone, during the inflammatory early phases of the proliferation stage during ossteogenesis [8]. Secondary stability is achieved by the growth and remodeling of bone around the implant which is indirectly related to the primary stability while the process of bone formation and remodeling is taking place [9].

Factors influencing primary implant stability are predominantly related to the bone quality, implant design, patient anatomical structures and the surgical technique [1].

However, factors which influence the secondary implant stability are related to the enhancement of the stability as a result of peri-implant bone formation through gradual bone remodeling and ossteogenesis, with the possibility of new bone formation at the implant-bone interface [9].

There are three non-invasive methods to measure the implant stability at the time of uncovery; percussion test, damping capacity assessment (Periotest- damping capacity assessment) and resonance frequency analysis (RFA) is a method used to determine stability (the level of osseointegration) in dental implants (Osstell, Stampgatan 14 SE 411 01 Gothenburg, Sweden). The stability is presented as an implant stability quotient (ISQ) value. Studies by zix et al. [10] have demonstrated that periotest is more susceptible to clinical measurement variables when compared to Osstell readings, upon comparison with provided reproducible results Lachman et al. concluded that Osstell was shown to be a more precise technique for measuring implant stability [11].

Case Report

A 48 year old male patient came for a dental consultation on the 27th August 2009. After a thorough clinical and radiographic (Figure 1) examination of tooth #16, a periodental abscess and distal pocket with the depth of 13 mm was found. Full mouth subgingival scaling and curettage was performed on the 5th of September 2009 along with antibiotic therapy. Extraction of tooth #16 was performed on September 28th 2009. An Implant with the dimensions of 5.8x9 mm Biohorizon (2300 Riverchase Center Birmingham, AL 35244 USA) was placed on tooth #16 a week post extraction on 5th October 2009 (Figures 2 and 3). Plans were made for implant uncovery after 6 months due to type IV bone quality, but the patient was unable to attend for the uncovery appointment.

After approximately 3 years on August 18th 2012 the patient reported for the Uncovery visit (Figure 4), the implant stability was assessed by means of osstell device. The ISQ readings for buccal, occlusal, palatal area were 14, 20 and 17 respectively (Figure 5).

A screw retained provisional restoration (using a light cured zirconium silicate micro ceramic indirect restoration called Ceramage- SHOFU Dental GmbH, Am Brüll 17, and 40878 Ratingen, Germany) was fabricated approximately 3 mm out of the occlusion and the patient was asked to chew on it with caution (Figure 6).

***Corresponding author:** Souheil Hussaini, BDS. MS and Milad DDS, Oral Implantology Research Institute, Knowledge Village, #39, Block 18, P.O. Box 39695 Dubai, UAE, E-mail: info@ID-SC.com

Received: June 01, 2016 **Accepted:** July 07, 2016 **Published:** July 12, 2016

Figure 1: Diagnostic panoramic radiograph.

Figure 2: Panoramic radiograph after implant placement.

Figure 3: Implant placement.

After 3 months, September 3rd 2012, the patient returned and the stability of the implants was re-examined using the Osstell device. The provisional restoration proved to be more success due to the increased ISQ readings 19,44 and 44 for buccal, Occlusal and palatal respectively (Figure 7). There was a noticeable improvement in regards to the stability of the implant after the controlled loading of the implant by using a provisional composite crown. The occlusion was adjusted 1mm a month regularly and the ISQ measured. The height of the provisional composite crown was increased to 1mm out of occlusion. After 3 months, February 13th 2013 the patient returned to the clinic and the ISQ readings for buccal, occlusal and palatal were 77,77 and 77 respectively (Figure 8). Finally, a permanent full contoured Ceramage UCLA crown was fabricated for the patient as a long term restoration.

After 3 years on May 3rd 2016, since the first ISQ value assessment of 14,20 and 17 and initial loading date which was on August 18th 2012 the patient came for a follow-up maintenance and checkup visit, whereby the ISQ reading for buccal, occlusal and palatal was 80,80 and 80 respectively (Figures 9-12).

Discussion

This study presents that when the ISQ measurement of the implant during uncovery was insufficient, by sequential occlusal loading, the implants stability and ISQ measurement increased over time [5].

The RFA measurements during uncovery after 3 years from placement showed an RF of 2.00 kHz (ISQ 14) as a mean value, indicating that such a low primary stability even after 6 months of healing period will not improve if more time is allotted for

Figure 4: Open-tray impression technique.

Figure 5: Osstell reading at uncover stage.

Figure 6: UCLA Provisional crown 3mm out of occlusion.

Figure 7: Osstell reading after 3 months of loading with the provisional restoration.

Figure 8: Osstell reading after 6 months of loading.

Figure 9: After 3 years, maintenance follow up/ buccal view.

Figure 10: After 3 years, maintenance follow up/ occlusal view demonstrating pink and healthy gingival around the crown with bad oral hygiene and no maintenance recall in these years.

Figure 11: Insertion of the osstell device.

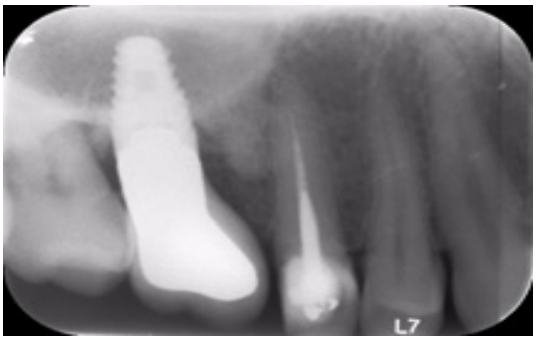

Figure 12: Osstell reading after 4 years of loading.

osseointigration. For the majority of the implants that fall under 60 ISQ we generally wait a period of four weeks to achieve better osseointigration [9-10].

Romanos et al. [12] performed a histological and histomorphometrical evaluation peri implant bone in the posterior mandible. And he found that peri implant mineralized bone areas presented statistically significant higher density of bone between the threads of loaded implants [13-20].

Loading of the implants seemed to increase the ossification of the alveolar bone around endosseous implants [17].

Even though, in the periapical radiograph the bone quality level do not seem to be sufficient enough for implant loading, however, the ISQ value of 80 demonstrates sufficient bone contact for loading (Figure 13).

Figure 13: Peri-apical radiograph demonstrating only one third of implant is covered by bone after 7 years post placement and 4 years of loading.

Conclusion

Placing the implant with low ISQ value on controlled progressive loading protocol over a period of 6 months can improve the stability and ISQ value of the implant.

References

1. Javed F, Almas K, Crespi R, Romanos GE (2011) Implant surface morphology and primary stability: is there a connection? Implant Dent 20: 40-46.
2. Lum LB, Beirne OR, Curtis DA (1991) Histologic Evaluation of Hydroxylapatite Coated Versus Uncoated Titanium Blade Implants in Delayed and Immediately Loaded Applications. Int J Oral & Maxillofac Implant 6: 150-161.
3. Szmukler-Moncler S, Salama H, Reingewirtz Y, Dubruille JH (1998) Timing of loading and effect of micromotion on bone-dental implant interface: review of experimental literature. J Biomed Mat Res 43: 192-203.
4. De Smet E, Jaecques S, Vandamme K, Vander Sloten J, Naert I (2005) Positive effect of early loading on implant stability in the bi-cortical guinea-pig model. Clin Oral Implants Res 16: 402-407.
5. Esposito M, Grusovin MG, Willings M, Coulthard P, Worthington HV (2007) The effectiveness of immediate, early, and conventional loading of dental implants: a Cochrane systematic review of randomized controlled clinical trials. Int J Oral Maxillofac Implants 22: 893-904.
6. Javed F, Romanos GE (2010) The role of primary stability for successful immediate loading of dental implants. A literature review. J Dent 38: 612-620.
7. Park JC, Lee JW, Kim SM, Lee JH (2011) Implant Stability-Measuring Devices and Randomized Clinical Trial for ISQ Value Change Pattern Measured from Two Different Directions by Magnetic RFA. INTECH Open Access Publisher.
8. Albrektsson T, Zarb G, Worthington P, Eriksson AR (1986) The long-term efficacy of currently used dental implants: a review and proposed criteria of success. Int J Oral Maxillofac Implants 1: 11-25.
9. Strnad J, Urban K, Povysil C, Strnad Z (2008) Secondary stability assessment of titanium implants with alkali-etched surface: a resonance frequency analysis study in beagle dogs. Int J Oral Maxillofac Implants, 23: 502-512.
10. Zix J, Kessler-Liechti G, Mericske-Stern R (2005) Stability measurements of 1-stage implants in the maxilla by means of resonance frequency analysis: a pilot study. Int J Oral Maxillofac Implants 20: 747-742.
11. Al-Jetaily S, Al-Dosari AA (2011) Assessment of Osstell™ and Periotest® systems in measuring dental implant stability (in vitro study). Saudi Dent J 23: 17-21.
12. Romanos GE, Toh CG, Siar CH, Swaminathan D (2002) Histologic and histomorphometric evaluation of peri-implant bone subjected to immediate loading: an experimental study with Macaca fascicularis. Int J Oral Maxillofac Implants 17: 44-51.
13. Aparicio C, Lang NP, Rangert B (2006) Validity and clinical significance of biomechanical testing of implant/bone interface. Clin Oral Implants Res 2: 2-7.
14. Atsumi M, Park SH, Wang HL (2007) Methods used to assess implant stability: current status. Int J Oral Maxillofac Implants 22: 743-54.
15. Barewal RM, Oates TW, Meredith N, Cochran DL (2003) Resonance frequency measurement of implant stability in vivo on implants with a sandblasted and acid-etched surface. Int J Oral Maxillofac Implants 18: 641-651.
16. Beer A, Gahleitner A, Holm A, Tschabitscher M, Homolka P (2003) Correlation of insertion torques with bone mineral density from dental quantitative CT in the mandible. Clin Oral Implants Res 14: 616-620.
17. Alghamdi AD, Alshehr F, Alghamdi M, Sukumaran A (2015) Influence of Dimensions on the Primary Stability and Removal Torque of Short Dental Implants. Journal of Dental and Oral Health 4: 2.
18. Glauser R, Sennerby L, Meredith N, Rée A, Lundgren A, et al. (2004) Resonance frequency analysis of implants subjected to immediate or early functional occlusal loading. Clin Oral Implants Res 15: 428-434.
19. Herrero-Climent M, Santos-García R, Jaramillo-Santos R, Romero-Ruiz MM, Fernández-Palacin A, et al. (2013) Assessment of Osstell ISQ's reliability for implant stability measurement: A cross-sectional clinical study. Med Oral Patol Oral Cir Bucal 18: e877-e882.
20. Alsaadi G, Quirynen M, Michiels K, Jacobs R, van Steenberghe D (2007) A biomechanical assessment of the relation between the oral implant stability at insertion and subjective bone quality assessment. J Clin Periodontol 34: 359-366.

Author Affiliation

Oral Implantology Research Institute, Dubai, UAE

Top