



ORIGINAL RESEARCH PAPER

Prosthodontics

CONCEPT OF OSSEODENSIFICATION – A REVIEW

KEY WORDS: Implant, Primary Stability, Osseointegration, Osseodensification, Bone compaction.

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ABSTRACT

Osseointegration is defined as a direct structural and functional connection between ordered living bone and the surface of a load carrying implant. Factors, including surgical techniques, bone quantity and quality are a strong base for achieving primary stability. And this primary stability is considered to be a prerequisite for establishing good osseointegration. Concept of osseodensification enhances the bone density around dental implants and increases primary stability. This is a review article which describes the concept of osseodensification.

INTRODUCTION

The most important factor in the implant is the primary stability of implant mostly in the low-density bone which affects the integrity of the implant. The primary stability of the implant is the mechanical stability of the implant at the time of surgery. Factors affecting primary stability of the implant is the insertion torque, design, bone density, and surgical technique. Initially bone to implant contact is mechanical and not biological, therefore, due to surgical trauma 1mm around the implant body gets devitalized, resorbed, and remodelled leads to decrease primary stability of the implant. The maxillary posterior region has low-density bone which makes it difficult to attain high insertion torque and leads to decreased primary stability mostly in immediate loading cases. Many surgical techniques developed to increase the primary stability of an implant placed in low-density bone.

Recently Sala Huwais in 2013 introduces the novel implant site preparation technique termed osseodensification. A specially designed bur known as Densah bur used in this technique which creates compaction of an auto graft layer at the periphery and apex of the implant rotating in a clockwise and counter clockwise direction. Burs have more than four lands and large negative rake angle, works in non-cutting mode and tapered shank, cutting chisel edge so as they enter deeper in the bone they expand the osteotomy. It creates a layer of compacted bone along the periphery and apex of the implant surface. This equipment has two modes Clockwise in cutting direction which has 800 to 1200 rpm and counter clockwise in a non-cutting direction which has 800 to 1200 rpm. This equipment uses typical Bouncing motion of bur which moves in and out of the osteotomy.

This technique is useful in many situations where conventional techniques may not achieve the desired result. Immediate implant placement, Ridge expansion, Sub Crestal Sinus lift, Guided expansion graft.

Densah burs cut hard bone when rotating clockwise direction when rotating counter-clockwise direction (noncutting) is densify the soft bone copious amount of irrigation is needed between the bone and bur surfaces to minimize overheating. Investigators have proved that this compaction of bone is through controlled deformation includes viscoelastic and plastic mechanism. The load is kept beneath the strength of the bone so these osseodensification technique increases the insertion torque of implant to approximately 49 Ncm in low density bone in contrast to 25 Ncm using standard drilling technique. The bur to bone contact causes opposing axial force which is corresponding to the intensity of force applied, which is known as Real-time haptic feedback. This drilling concept has Spring back effect which creates a smaller osteotomy than standard drilling due to recovery elastic strain when the osteotome is removed from the site. This also helps in increasing the primary implant stability.

Lahen B et al., in their study examined the effect of OD on the

primary stability and early osseointegration of implants. Their results showed that the OD drilling technique significantly enhanced IT values which are considered in this study as a method to gauge device primary stability. After six weeks in vivo, histometric results suggest that the experimental groups drill design positively influenced osseointegration when utilised in both clockwise or counterclockwise (OD) directions. Thus they concluded that regardless of the design of implant, the OD drilling technique enhanced the primary stability.

Gaspar J in 2018 had done a study in the outcome of osseodensification technique for maxillary implant sites preparation in different clinical situations. Reduced bone ridge width, sinus augmentation by crestal approach, implant placement immediately after extraction, an implant placed in immediate loading in full arch rehabilitation. Osseodensification technique in all these cases shows higher insertion torque value and increased primary implant stability and in sinus augmentation also it shows safe, simple, with reduced morbidity.

Jimmy H Tian in 2018 had done a study on implant placement in atrophic mandibular alveolar ridge with alveolar ridge expansion conventional osteotome techniques (control group) and osseodensification technique (test group). Twelve endosteal implants were placed in porcine specimen six in the experimental group and six in the control group. Result revealed increased implant primary stability in osseodensification group from a biomechanical and histologic point.

Koutouzis T in 2019 had done a study on alveolar ridge expansion by osseodensification-mediated plastic deformation and compaction autografting-a multicenter retrospective study.

He concluded the study that osseodensification can alter the ridge dimensions and allow for ridge expansion with adequate trabecular bone volume greater expansion can be expected at the crest in narrow ridges.

Advantages of Osseodensification

Compaction autografting/condensation, Enhances bone density, Residual ridge expansion, Increases residual strain, Increases Implant Stability.

Contraindications of Osseodensification

Osseodensification does not work with cortical bone as cortical bone is a non dynamic tissue which lacks plasticity. Densification of xenografts should be avoided because they have only inorganic content and they just provide the bulk without any viscoelasticity.

CONCLUSION

The primary stability of the implant is the most important factor in implant especially in low density of bone-like posterior maxilla. With the introduction of specially

designed Densah burs, making Osseodensification possible, not only reduces treatment time but, also gives a successful implant outcome. It creates an autograft layer of condensed bone at the periphery of the implant bed with the use of Densah burs that rotate in a clockwise and anti-clockwise direction, thereby enhancing implant stability.

REFERENCES

1. Albrektsson T, Branemark PI, Hansson HA, Lindstrom J. Osseointegrated titanium implants. Requirements for ensuring a long lasting, direct bone to implant anchorage in man. *Acta Ortho Scand*, 1981;52:155-70.
2. Wennerberg A, Albrektsson T. Suggested guidelines for the topographic evaluation of implant surfaces. *Int J Oral Maxillofac Implants*. 2000;15:331-44.
3. Buchter A, Kleinheinz J, Wiesmann HP, Kersken J, Nienkemper M, Weythorther HV et al. Biological and biomechanical evaluation of bone remodelling and implant stability after using an osteotome technique. *Clin Oral Implants Res*, 2005;16:1-8.
4. Stavropoulos A, Nyengaard JR, Lang NP, Karring T. Immediate loading of single SLA implants: Drilling vs. osteotomes for the preparation of the implant site. *Clin Oral Implants Res* 2008;19:55-65.
5. Turkylmaz I, Aksoy U, McClumphy EA. Two alternative surgical techniques for enhancing primary implant stability in the posterior maxilla: A clinical study including bone density, insertion torque, and resonance frequency analysis data. *Clin Implant Dent Relat Res* 2008;10:231-237.
6. Yoon HG, Heo SJ, Koak JY, Kim SK, Lee SY. Effect of bone quality and implant surgical technique on implant stability quotient (ISQ) value. *J Adv Prosthodont* 2011;3:10-15.
7. Markovi A, Calasan D, Coli S, Stoj ev-Staj i L, Janji B, Miši T. Implant stability in posterior maxilla: bone condensing versus bone-drilling: a clinical study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 2011;112:557-563.
8. Huwais S. Enhancing implant stability with osseodensification-a case report with 2-year follow-up. *Implant practice*. 2015;8(1):28-34.
9. Trisi P, Berardini M, Falco A, Vulpiani MP. New osseodensification implant site preparation method to increase bone density in low-density bone: in vivo evaluation in sheep. *Implant Dent*. 2016;25(1):24-31.
10. Lahens B, Neiva R, Tovar N, Alifarag AM, Jimbo R, Bonfante EA, et al. Biomechanical and histologic basis of osseodensification drilling for endosteal implant placement in low density bone. An experimental study in sheep. *J Mech Behav Biomed Mater*. 2016;63:56-65.
11. Vandewalle S. Surface topographical changes. *Dent Implants Dentures*. 2016;1(1):107.
12. Huwais S, Meyer EG. A novel osseous densification approach in implant osteotomy preparation to increase biomechanical primary stability, bone mineral density and bone-to-implant contact. *Int J Oral Maxillofac Implants*. 2017;32(1):27-36.
13. Huwais S, Meyer EG. A Novel Osseous Densification Approach in Implant Osteotomy Preparation to Increase Biomechanical Primary Stability, Bone Mineral Density, and Bone-to-Implant Contact. *Int J Oral Max Impl*. 2017;1:32.
14. Gaspar J, Esteves T, Gaspar R, Rua J, João Mendes J. Osseodensification for implant site preparation in the maxilla a prospective study of 97 implants. *Clin Oral Implants Res*. 2018;29:163-164.
15. da Rosa M, Carlos J, de Oliveira Rosa AC, Huwais S. Use of the Immediate Dentoalveolar Restoration Technique Combined with Osseodensification in Periodontally Compromised Extraction Sites. *Int J Periodont Rest*. 2019;1:39.
16. Tian JH, Neiva R, Coelho PG, Witek L, Tovar NM, Lo IC et al. Alveolar Ridge Expansion: Comparison of Osseodensification and Conventional Osteotome Techniques. *J Craniofac Surg*. 2019;1:30:607-610.
17. Koutouzis T, Huwais S, Hasan F, Trahan W, Waldrop T, Neiva R. Alveolar Ridge Expansion by Osseodensification-Mediated Plastic Deformation and Compaction Autografting: A Multicenter Retrospective Study. *Implant Dent*. 2019;28:349-55.
18. Kalpana D. Implant Design Considerations – A Review. *Indian Journal of Research* 2020; Vol 9, Issue 6.