ISSN (O) : 2582-3271
PubMed-National Library of Medicine - ID: 101766917

International Journal of Dental Science and Clinical Research (IJDSCR)

Dr. Angel Vaidic Publication

Available Online at: http://www.ijdscr.org

Volume – 2, Issue – 4, July – August - 2020, Page No. : 17 - 23

Osseo densification: A Novel Approach In Implant

[1]Dr. Shaikh Mohammad Zubair, PG Student, CSMSS Dental College, Aurangabad, Maharashtra, India.

[2]Dr. Niraj Chaudhari, Associate Professor, CSMSS Dental College, Aurangabad, Maharashtra, India.

[3]Dr. Mayur Awchar, PG Student, CSMSS Dental College, Aurangabad, Maharashtra, India.

Citation Of This Article: Dr. Shaikh Mohammad Zubair, Dr. Niraj Chaudhari, Dr. Mayur Awchar,"E Osseo densification: A Novel Approach In Implant", IJDSCR July – August - 2020, Vo2. – 2, Issue -4, P. No. 17-23.

Corresponding Author: Dr. Shaikh Mohammad Zubair, PG Student, CSMSS Dental College, Aurangabad, Maharashtra, India.

Type of Publication: A Review Article

Conflicts of Interest: Nil

Abstract

Primary stability in dental implants is an essential factor for achieving successful osseointegration. Surgical procedure and bone quality are among the most common factors that affect primary stability. It is also crucial to achieve high-insertion torque which is important for obtaining primary stability. Maintaining sufficient bone bulk and density is essential to achieve necessary bone to implant contact for obtaining a biomechanically stable implant. A new concept for osteotomy called osseo densification (OD) has been at the forefront of changes in surgical site preparation in Implantology. This relatively new concept with universally compatible drills has been proposed to help in better osteotomy preparation. Bone densification achieves bone expansion at different sites of varying bone densities. This procedure has also shown improvement in achieving better implant primary stability and better osteotomy than conventional implant drills.

Keywords

Implant stability, Osseo densification, Osteotomy

Introduction

Osseo densification (OD) is a new method of biomechanical bone preparation performed for dental implant placement. Recently, studies using a new technique to replace bone subtractive drilling have been developed that will optimize the implant site. This technique is called osseo densification. It was introduced by Dr. Salah Huwais as a patented novel method in 2012.[1]

The procedure is characterized by low plastic deformation of bone that is created by rolling and sliding contact using a densifying bur that is fluted such that it densifies the bone with minimal heat elevation. Osseo densification, a bone non extraction technique, was developed by Huwais 2013[2] and done using specially designed burs

(Densah™ burs) that help densify bone [Figure 1] as they prepare an osteotomy.[3]

Figure 1: Versah Kit with densification drills

These burs provide advantages of both osteotomes combining the speed along with improved tactile control of the drills during osteotomy. Standard drills excavate bone during implant osteotomy, while osteotomes tend to induce fractures of the trabecular that requiring long remodeling time and delayed secondary implant stability. The Densah burs allow for bone preservation and condensation through compaction auto grafting during osteotomy preparation, thereby increasing the bone density in the peri-implant areas and improving the implant mechanical stability.[4]

Unlike traditional osteotomy, osseo densification does not excavate bone but simultaneously compacts and auto grafts the particulate bone in an outward direction to create the osteotomy, thereby preserving vital bone tissue. This is achieved using specialized dandifying burs [Figure 2]. When the specialized drill is used at high speed in an anticlockwise direction with steady external irrigation (Dandifying Mode), the dense compact bone tissue is created along the osteotomy walls.[5]

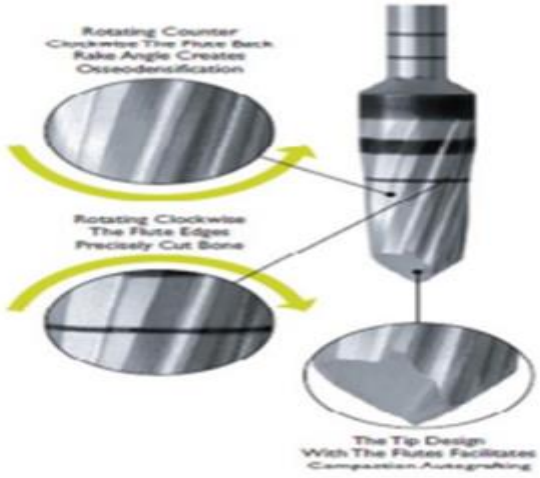

Figure 2: Role of densification Drills (image source: Versah LLC)

The pumping motion (in and out movement) creates a rate-dependent stress to produce a rate-dependent strain and allows saline solution pumping to gently pressurize the bone walls. This combination facilitates an increased bone plasticity and bone expansion [Figure 3]. Huwais demonstrated that osseodensification helped ridge expansion while maintaining alveolar ridge integrity, thereby allowing implant placement in autogenously bone, also achieving adequate primary stability. Osseo densification helped in preserving bone bulk and shortened the waiting period to restorative phase.[6]

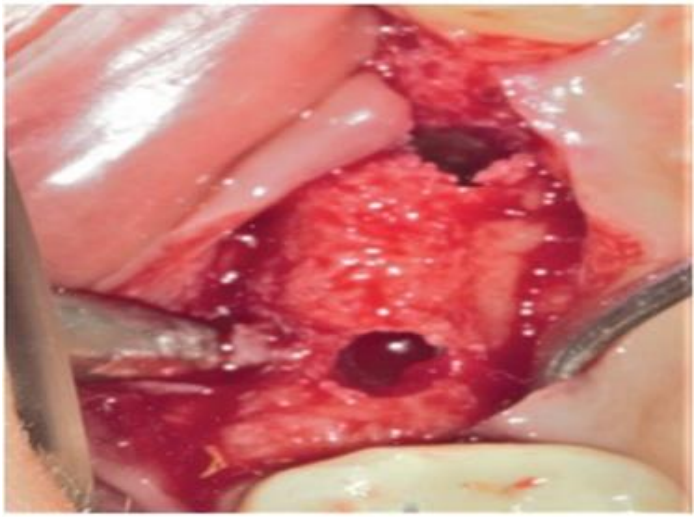

Figure 3: Osteotomy preparation using the densification drill

Various Aspects Of Osseo densification

Osseo densification And Bone Density

The process of osseointegration leads to bone formation on the implant surface and contributes to implant secondary stability between bone and dental implant.

In areas of low bone density, such as maxillary posterior region, the insufficient bone available could affect the histomorphometric parameters such as %BIC(Bone–implant contact) and %BV(BV: Bone volume) negatively, thereby affecting primary and secondary implant stability. A layer of increased bone mineral density has been shown by imaging around the periphery of osteotomies using osseodensification.

Osseo densification And Primary Stability

The implant primary stability is a crucial factor to achieve implant osseointegration.[7] High primary implant stability is critical in immediate loading protocols, and it was reported that an implant micro motion above 50–100 um potentiated peri-implant bone resorption or implant failures.[8-10]

Berardini et al.[11] and Li et al.[12] in a review reported no significant difference in crestal bone resorption and failure rate between implants inserted with either high- or low-insertion torque values. They also demonstrated the ability of osseodensification drills to increase the % of BV(BV: Bone volume) and % of BIC(Bone–implant contact) for dental implants inserted into poor density bone compared to conventional osteotomies, which may help in enhancing osseointegration,[13,14].

Newer methods such as cutting torque resistance analysis developed by Johansson and Strid was also suggested as a tool to evaluate implant primary stability,[15]

Osseo densification Versus Conventional Osteotomy

Biomechanical capabilities of implants are affected by various factors, which include implant macro/micro geometry, Nano surface modifications, and osteotomy techniques employed.[14,16] Standard drills used in implant site osteotomy excavate bone to facilitate implant placement. They produce effective cutting of bone but lack the design capability to create a precise circumferential osteotomy. Osteotomies, therefore, become elongated and elliptical due to the imprecise cutting of the drills. This leads to a reduction of torque during implant insertion, leading to poor primary stability and contributing to the potential for no integration of implant.

Osseo densification osteotomy diameters were found to be smaller than conventional osteotomies prepared with the same burs due to the springy nature and elastic strain of bone. This increased the percent of bone available at the implant site by about three times. Histomorphological analysis has demonstrated the presence of autogenously bone fragments in the osseodensified osteotomy sites, especially in the bone of low mineral density relative to regular drills.[17] These fragments acted as nucleating surfaces promoting new bone formation around the implants and providing greater bone density and better stability. Gil et al. found no statistically significant difference in bone-area-fraction occupancy as a result of drilling technique ($P = 0.22$).[18]Under sizing the implant site preparation[19,20] and using the osteotomes for bone 6 condensation[21,22] are some of the surgical methods advised to increase primary stability in implants and % of BIC(Bone–implant contact) in poor density bone. Observations were also made of different healing patterns and peri-implant bone-remodeling models.[23-25]

Various Studies In Osseo densification

AUTHOR	TYPE OF STUDY	SAMPLE SIZE	STUDY CONDUCTED	OUTCOME
Lahens, 2016	In vivo animal study	**5**	Effect of OD on the initial stability and early osseointegration of conical and parallel walled implants in low-density bone (total implants=30; 15 parallel, 15 conical)	Significantly higher BIC to OD techniques (P
Erich Meyer, Daniel Green shields, Salah Huwais	In vivo animal study	**12**	Three preparation techniques i. SD with rotary bur ii. ED with Densah® bur iii. OD with Densah® bur rotating in reversed, noncutting direction (total sites=72	No differences in ISQ between the groups 3°C increase during drilling and 6°C during OD Bone mineral density increased around periphery and bottom of OD holes Bone particles autografted into walls and bottom creating smoother OD holes BIC was increased to 3 times for OD versus SD
Trisi P , Bernardini M, Falco A , Podaliri Vulpiani	In vivo animal study	**2**	Ten 3.8 mm ×10 mm implants were inserted in the left side using the conventional drilling method (control group) Ten 5 mm ×10 mm implants were inserted in the right side (test group) using the OD procedure (Versah)	No implant failures were observed after 2 months of healing Significant increase of ridge width and (%BV) (approximately 30% higher) was detected in the test group Significantly better removal torque values and micromotion under lateral forces (value of actual micromotion) were recorded for the test group in respect with the control group
Lipton D, Trahan W, Hasan F, et al. Osseodensification as a novel implant preparation technique that facilitates ridge expansion by compaction autografting. Am Acad Periodontol Sci Annu Meet. 2015.	In vivo animal study	**21**	28 implants were placed in 21 patients. Alveolar ridge widths were broken down into 3 groups; Group 1: 3-4 mm (n=9), Group 2: 5-6 mm (n=12) and Group 3: 7-8 mm (n=7). Each ridge was measured utilizing bone calipers at 2 levels, crestal and an apical position (10 mm apical to the crestal measurement) prior to and post osteotomy preparation. Post implant placement insertion torque values were registered and ISQ values were documented.	Greater bone expansion occurred at the coronal position compared to the apical. The greatest percentage of bone expansion was recorded on initially narrower ridges compared to wider ridges. All implants placed in this study had good primary stability with insertion torque values ≥50 N/cm and ISQ values ≥68.
Drs. Ann Marie Hofbauer and Salah Huwais	In vivo human study : A Case Report	**1**	A 1.7-mm initial pilot osteotomy was created to a depth of 13 mm. The pilot drill was rotating at 1200	Osseodensification utilizing the Densah™ Bur technology produces stronger

			RPM in a clockwise (CW) rotation. Using the pilot drill as a paralleling pin, an X-ray was taken to confirm the angulation between the adjacent teeth and the implant. Implant stability was tested with an (Osstell®) ISQ implant stability meter. Buccal-lingual ISQ reading was 81.	osteotomy for any implant. It preserves the bone to enhance the host. This allows for clinical versatility, which may facilitate enhanced implant stability and efficient expansion of any ridge in either jaw.

SD: Standard drilling, ED: Extraction drilling, OD: Osseo densification, BIC: Bone–implant contact, ISQ: Implant stability quotient, %BV: Bone volume percentage

The alternative to implant drilling procedures in the posterior maxilla is the osteotome technique [19] that aims to compact the bone with the mechanical action of cylindrical instruments along the osteotomy walls. This procedure created trabecular fractures with debris, which caused an obstruction to the process of osseointegration.[26]

Conclusion

Osseo densification is a specialized procedure for osteotomy preparation that is inherently bone preserving. Unlike conventional osteotomy, it uses specialized high-speed densifying burs to prepare osteotomy and auto graft bone in the phase of plastic deformation. These results in an expanded osteotomy with preserved and dense compacted bone tissue that helps maintain ridge integrity and allows implant placement with superior stability. Use of versah drills in osseodensification led to the formation of undersized osteotomy when compared to conventional drills. It helped improve bone density and also increased the percent of bone volume and increased bone-to-implant contact, thereby improving implant stability.

References

1. Huwais S, Meyer EG. A novel osseous densifi cation approach in implant osteotomy preparation to increase biomechanical primary stability, bone mineral density, and bone-to-implant contact. Int J Oral Maxillofac Implants 2017;32:27-36.
2. Huwais S. Inventor; Fluted osteotome and surgical method for use. US Patent Application US2013/0004918; 3 January, 2013.
3. Huwais S. Autografting Osteotome. WO2014/077920. Geneva, Switzerland: World Intellectual Property Organization Publication; 2014.
4. Huwais S, Meyer E. Osseodensification: A novel approach in implant osteotomy preparation to increase primary stability, bone mineral density and bone to implant contact. Int J Oral Maxillofac Implants 2016;32:27-36.
5. Meyer EG, Huwais S. Osseodensification is a Novel Implant Preparation Technique that Increases Implant Primary Stability by Compaction and Auto-Grafting Bone. San Francisco, CA: American Academy of Periodontology; 2014.
6. Huwais S. Enhancing implant stability with osseodensification: A two year follow up. Implant Pract 2015;8:28-34
7. Albrektsson T, Brånemark PI, Hansson HA, Lindström J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand 1981;52:155-70.
8. Søballe K, Brockstedt-Rasmussen H, Hansen ES, Bünger C. Hydroxyapatite coating modifies implant

membrane formation. Controlled micromotion studied in dogs. Acta Orthop Scand 1992;63:128-40.

9. Søballe K, Hansen ES, Brockstedt-Rasmussen H, Bünger C. Hydroxyapatite coating converts fibrous tissue to bone around loaded implants. J Bone Joint Surg Br 1993;75:270-8.
10. Szmukler-Moncler S, Salama H, Reingewirtz Y, Dubruille JH. Timing of loading and effect of micromotion on bone-dental implant interface: Review of experimental literature. J Biomed Mater Res 1998;43:192-203.
11. Berardini M, Trisi P, Sinjari B, Rutjes AW, Caputi S. The effects of high insertion torque versus low insertion torque on marginal bone resorption and implant failure rates: A systematic review with meta-analyses. Implant Dent 2016;25:532-40.
12. Li H, Liang Y, Zheng Q. Meta-analysis of correlations between marginal bone resorption and high insertion torque of dental implants. Int J Oral Maxillofac Implants 2015;30:767-72.
13. Trisi P, Berardini M, Falco A, Podaliri Vulpiani M. New osseodensification implant site preparation method to increase bone density in low-density bone: In vivo evaluation in sheep. Implant Dent 2016;25:24-31.
14. 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.
15. Swami V, Vijayaraghavan V, Swami V. Current trends to measure implant stability. J Indian Prosthodont Soc 2016;16:124-30. 9
16. Coelho PG, Jimbo R. Osseointegration of metallic devices: Current trends based on implant hardware design. Arch Biochem Biophys 2014;561:99-108.
17. 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.
18. Gil LF, Sarendranath A, Neiva R, Marão HF, Tovar N, Bonfante EA, et al. Bone healing around dental implants: Simplified vs. conventional drilling protocols at speed of 400 rpm. Int J Oral Maxillofac Implants 2017;32:329-36.
19. Alghamdi H, Anand PS, Anil S. Undersized implant site preparation to enhance primary implant stability in poor bone density: A prospective clinical study. J Oral Maxillofac Surg 2011;69:e506-12.
20. Degidi M, Daprile G, Piattelli A. Influence of underpreparation on primary stability of implants inserted in poor quality bone sites: An in vitro study. J Oral Maxillofac Surg 2015;73:1084-8.
21. Summers RB. A new concept in maxillary implant surgery: The osteotome technique. Compendium 1994;15:152, 154-6, 158.
22. Boustany CM, Reed H, Cunningham G, Richards M, Kanawati A. Effect of a modified stepped osteotomy on the primary stability of dental implants in low-density bone: A cadaver study. Int J Oral Maxillofac Implants 2015;30:48-55.
23. Campos FE, Gomes JB, Marin C, Teixeira HS, Suzuki M, Witek L, et al. Effect of drilling dimension on implant placement torque and early osseointegration stages: An experimental study in dogs. J Oral Maxillofac Surg 2012;70:e43-50.
24. Coelho PG, Marin C, Teixeira HS, Campos FE, Gomes JB, Guastaldi F, et al. Biomechanical

evaluation of undersized drilling on implant biomechanical stability at early implantation times. J Oral Maxillofac Surg 2013;71:e69-75.

25. Munjal S, Munjal S, Hazari P, Mahajan H, Munjal A, Mehta DS, et al. Evaluation of specifically designed implants placed in the low-density jaw bones: A clinico-radiographical study. Contemp Clin Dent 2015;6:40-3.
26. Büchter A, Kleinheinz J, Wiesmann HP, Kersken J, Nienkemper M, Weyhrother 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.