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Short Communication

Osseodensification: A Boon in Dental Implantology

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A new technique for biomechanical bone preparation before placing dental implants is known as osseodensification (OD). Low plastic deformation of the bone, caused by rolling and sliding contact with a densifying bur that is fluted to densify the bone with a little heat elevation, is what makes the process distinctive. Huwais 2013[1] invented the bone non-extraction approach known as OD, which involves preparing an osteotomy while employing the burs (DensahTM burs) that have been precisely engineered to help densify the bone. These burs offer benefits of both osteotomes by combining speed and better tactile drill control during osteotomy. Standard drills remove bone during implant osteotomy, however, osteotomes frequently result in fracture of the trabeculae, delaying secondary implant stability and further necessitating extended remodeling time. During osteotomy preparation, the Densah burs enable bone preservation and condensation through compaction autografting, increasing bone density around the implant, and enhancing its mechanical stability [2]. To allow strains in the walls of the osteotomy to reach or go beyond the bone microdamage threshold, traditional drills must first remove a significant amount of bone. This damage must then be repaired by the bone-remodeling unit for more than 12 weeks. Therefore, OD will aid in maintaining the bone volume and increasing the bone density, thereby decreasing the healing time.

Contrary to the standard osteotomy, OD preserves the vital bone tissue by concurrently compacting and autografting the particulate bone in an outward orientation to form the osteotomy. Utilizing specialized densifying burs, the process of OD can be accomplished. The dense compact bone tissue is produced along the osteotomy walls when the specialized drill is employed at a high speed in an anticlockwise direction with constant external irrigation (Densifying Mode) [3]. Saline solution pumping can gently pressurize the bone walls by using the pumping motion (in and out movement) to produce rate-dependent stress that results in a rate-dependent strain. Increased bone plasticity and bone expansion are made possible by this combination. Huwais showed how OD assisted in ridge extension while retaining the integrity of the alveolar ridge, enabling the placement of implants in an autogenous bone and attaining sufficient primary stability. OD facilitated the preservation of bone bulk and reduced the waiting period until the restorative phase [4].

The osseointegration process results in the formation of bone on the implant surface and helps to maintain secondary stability between the implant and the bone.

In regions with low bone density, such as the maxillary posterior region, the lack of accessible bone may severely impact histomorphometric indices like %BIC and %BV, impacting the primary as well as the secondary implant stability. A layer of enhanced bone mineral density has been observed by imaging around the periphery of osteotomies using OD. Secondary stability has been demonstrated to be potentiated by the increase in bone density brought about by OD.

Several parameters, including implant macro/microgeometry, nanosurface changes, and osteotomy procedures used, have an impact on the biomechanical capabilities of the implants [5].

Standard drills for implant site osteotomy remove bone to make room for the implant. Although they effectively cut the bone, they are unable to design an accurate circumferential osteotomy. As a result of the drills' sloppy cutting, osteotomies become elongated and take on an elliptical shape. Due to inadequate primary stability and risk for implant non-integration, this causes a reduction in the torque during implant insertion. Additionally, osteotomies performed on the bone with insufficient density might result in buccal or lingual dehiscence, which decreases the primary stability, necessitates augmentation using a second bone graft, raises the overall cost of care, and prolongs the healing process.

Some of the surgical techniques recommended to increase the primary stability in implants and the percentage of BIC in low-density bone include underestimating the implant site preparation and employing osteotomes for bone condensation [6]. The osteotome technique seeks to compact the bone using the mechanical action of cylindrical devices along the osteotomy walls as a substitute for implant drilling techniques in the posterior maxilla. Because of this procedure, trabecular fractures filled with debris were produced, obstructing the osseointegration process [7].

Due to the springy quality and elastic strain of bone, OD osteotomy diameters were discovered to be lower than traditional osteotomies performed with identical burs. This roughly tripled the amount of bone that was readily available at the implant location. The existence of autogenous bone pieces in the osseodensified osteotomy sites has been shown by histomorphological examination, particularly in the bone with low mineral density in comparison to the standard drills. These pieces served as nucleating surfaces to encourage the creation of new bone surrounding the implants, increasing bone density and improving stability [8].

One of the most important elements affecting the outcome of implant therapy is the primary stability during implant placement. Bone density, surgical technique, implant thread type, and geometry are crucial elements in improving the implant's primary stability. The mechanical contact between the walls of the implant osteotomy and the exterior implant surface provides primary stability [9]. High insertion torque could greatly improve the initial bone-to-implant contact percentage (% BIC) compared to an implant placed with low insertion torque values. The insertion torque peak is strongly connected to implant primary stability and host bone density. Ottoni et al [10] demonstrated that for every 9.8 Ncm increase in torque, the failure rate for single-tooth implant restoration decreased by 20%.

To achieve implant osseointegration, the primary stability of the implant is essential. In immediate loading protocols, high primary implant stability is essential, and it has been noted that implant micromotion above 50-100 um might exacerbate peri-implant bone loss or implant failures [11]. An increase in bone density values, a sizable increase in insertion torque, and a corresponding decrease in micromotion were observed. In a review, Berardini et al. and Li et al. [12] found no discernible difference between implants inserted with high- or low-insertion torque values in crestal bone resorption or failure rate. Additionally, they showed that OD drills can raise the BV and BIC for dental implants placed in bone with low density when compared to traditional osteotomies, which may aid in promoting osseointegration.

Inherently bone-preserving, OD is a specific approach for osteotomy preparation. Instead of using standard osteotomies, it prepares autograft bone and osteotomies using specialized, high-speed densifying burs. As a result, the osteotomy is widened, leaving behind densely compacted bone tissue that is conserved, helping to retain the integrity of the ridge and enabling the placement of the implants with greater stability. When compared to conventional drills, the use of Versah drills in OD led to the creation of smaller osteotomies. It helped improve bone density and also raised the % of BV and increased bone-to-implant contact, hence enhancing implant stability. Further research is required in this area because the review of the literature currently available is not sufficient to support any firm conclusions.

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