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Role Of Piezosurgery in Oral and Maxillofacial Surgery- A Review

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ABSTRACT

Piezo surgery enables controlled cutting of hard tissues by employing modified ultrasonic vibration. Sensitive hard constructions can be cut effectively and with incredible accuracy, without obliteration of delicate soft tissue. We have discovered this gadget to be valuable when the precise cutting of thin bones is fundamental. Nonetheless, it is of just restricted use in cutting thick bones and in regions with restricted access. This overview summarises current research and involvement in piezo surgery, a promising, meticulous, and delicate tissue-saving framework for bone cutting based on ultrasonic micro-vibrations. Delicate tissue protection, optimal visibility in the operating room, less blood loss, reduced vibration and noise, assurance of tooth structure, and increased patient comfort are some of the key advantages of piezo surgery.

Keyword: *Piezo surgery, oral and maxillofacial surgery, Uses and Limitations.*

1. INTRODUCTION

Piezo surgery (piezoelectric bone surgery) is a promising, precise, and delicate tissue-sparing framework for bone cutting that employs ultrasonic microvibrations. It was developed by Italian oral surgeon Tomaso Vercellotti in 1988 to overcome the limitations of traditional apparatus in oral surgery by changing and expanding on existing ultrasonic advances. Not only is this strategy clinically powerful, but histological and histomorphometric proof of wound mending and bone development in animal models has also shown that tissue reaction is more ideal in piezo surgery than it is in traditional bone-cutting procedures, for example, precious stone or carbide rotational instruments[1]. Shock waves in the liquid climate help in decreasing the degrees of microscopic organisms, giving a disinfection activity[2]. The quantity of signs for piezo surgery is expanding in oral and maxillofacial surgery and in different fields like otorhinolaryngology, neurosurgery, ophthalmology, traumatology, and orthopaedics.

Piezo surgery depends on the piezoelectric effect, first depicted by Jean and Marie Curie in 1880, which expresses that certain earthenware production and gems twist when an electric flow is passed across them, bringing about motions of ultrasonic frequency. The vibrations acquired are intensified and moved to a vibration tip which, when applied with slight tension on bone tissue, brings about a cavitation marvel – a mechanical cutting impact that happens solely on mineralized tissue[3]. A piezo surgery unit is multiple times as incredible as a traditional ultrasonic dental unit, permitting it to cut exceptionally mineralised cortical bone. The main piece of the gadget is the piezoelectric handpiece, associated with the primary unit, which has holders for the handpiece and water system liquids. A foot switch for activating the interchangeable handpiece tips. The recurrence of vibrations and the force of cutting, just as the measure of the water system, can be changed. The frequency is generally set somewhere in the range of 25 and 30 kHz. A few instrument tips (embeds) of various sizes, shapes, and materials are accessible, furthermore, new ones are being created. They can be covered with titanium or diamond of various grades. The piezoelectric versions include a sharp-tipped saw, a bone harvester, a scalpel, and a cone compressor

Advantages of piezo surgery:

Piezo surgery was developed for securely performing sinus lift activities; however, new indications are as yet showing up. The device is by and large helpful in cases in which bone should be sliced near significant delicate tissues like nerves, vessels, Schneiderian film, and dura mater, where mechanical or warm injury should be kept away from. direct openness of a nerve to piezo surgery, indeed, even in most pessimistic scenario situations, doesn't take apart the nerve yet just prompts a few underlying or practical harm. In most cases, the nerve can recover with the perineural sheath unblemished, as opposed to

utilizing a customary drill or oscillating saw[4]. They additionally saw that the degree of harm was essentially higher with the use of expanded power on the nerve by the gadget, yet not by the enactment of ultrasonic vibration. This property makes piezo surgery a promising tool for doing osteotomies near nerves. The operating field in piezo surgery remains practically liberated from blood during the cutting strategy

Bone graft harvesting and biopsy:

Bone graft harvesting incorporates a few techniques for acquiring chips or blocks of bone tissue. Bone chips are utilized as space creators and guides for bone recovery through osteoconduction, and for supporting development factors at the beneficiary site to accelerate bone healing. Bone squares ought to be utilized when enormous imperfections need to be filled or when the immobilization of particulate uniting material is impossible. Piezo surgery is significant in bone harvesting, which additionally incorporates bone partition by burs, bone scrapers, backaction, gouge-molded bone chisels, trephines, rongeurs, and en bloc harvesting. It is also possible to obtain a biopsy sample using peizosurgery. The fundamental benefit of the example hence acquired is that the constructions of the careful bone edges are less impeded by this strategy compared and ordinary burs[5].

Sinus lift:

The sinus augmentation procedure is the generally acknowledged pre-prosthetic best quality level for making adequate bone volume for the placement of endosseous implants in an atrophic posterior maxilla. The most common intraoperative difficulty of the sinus elevation operation is perforation of the sinus mucosa (Schneiderian membrane), which is estimated to occur in 14-56% of cases[6]. Fixing perforations might be simple, troublesome, or unthinkable. For this reason, a few procedures have been proposed, including the utilization of a bioabsorbable collagen-barrier membrane. In the creators' experience, this system fundamentally expands expenses and usable time, and builds the risk of patient dissatisfaction as far as postoperative oedema, sinus blockage, or sinus graft infection rate. Bone tissue deficit is generally reduced during sinus lift using piezo surgery[7]. The mucosa can be removed from the bone with a cone compressor without causing injury.

Other indications in oral surgery:

Explicit oral surgery procedures include osteogenic distraction, ridge expansion, endodontic surgery, periodontal surgery, inferior alveolar nerve decompression, cyst removal, and dental extraction, which mostly affects teeth[8]. A bone cut by piezo surgery seems to mend all the more productively at first during osseointegration of oral titanium implants, as displayed in investigations utilizing minipigs[9] or humans.

Craniomaxillofacial surgery:

Since its introduction in oral medical procedures, the utilization of piezo surgery has quickly spread into craniomaxillofacial techniques, fundamentally orthognathic and reconstructive medical procedures. piezosurgery permits extremely exact cutting; maintains a strategic distance from bone cutting utilizing an osteotome; saves delicate tissue such as cerebrum, dura mater, palatal mucosa, and the inferior alveolar nerve; and increments the hour of bone cutting, however not the by overall time, because there was no prerequisite for delicate tissue assurance. The gadget's absence of force seems, by all accounts, to be a minor issue compared and its advantages[3].

Orthognathic surgery:

The utilization of piezosurgery in a few orthognathic surgeries is acquiring the interest of maxillofacial surgeons. It has been utilized for minor orthodontic microsurgical procedures, and for orthognathic surgeries like BSSO, surgically assisted maxillary expansion (SARME) and Le fort I osteotomy[10,11]. The surgical blade utilized for Le Fort I osteotomy is somewhat bended at the base, and it becomes rectilinear, more extensive and slenderer at the limit. With light tension, it is moved along the Le Fort I line, accomplishing complete segment of the outside and inward cortex of the anterolateral maxilla. Osteotomy of the pterygomaxillary intersection is performed with a more extensive and thicker surgical blade that is bended toward inside, with the state of the art practically opposite to the long hub of the handpiece. The tip of the piezoelectric surgical tool can be touched at the level of the hamular notch. Admittance to the posterior regions during Le Fort I osteotomy with piezosurgery is for the most part very troublesome inside the restricted posterolateral space. Cuts between the teeth can be made exactly, with most extreme saving of the nearby bone and without critical danger of giving and taking tooth vitality.

Removal of osteosynthetic materials:

The arrangement of callus that covers miniplates and screws, making the expulsion of such gadgets troublesome, is a typical issue in maxillofacial surgery. Utilizing piezosurgery, the expulsion of such callus is fast and protected, without harming the screw sets out toward resulting screwdriver use[12].

Reconstructive procedures:

The job of piezosurgery in reconstructive surgery is gradually expanding. CROSETTI et al. asserted that the fundamental benefits of this method are: accuracy in performing osteotomies near significant delicate tissues like the inferior alveolar

nerve or on the other hand the dura mater; minimal bleeding from delicate tissues encompassing the osteotomy line; and insignificant injury to the bony part of the flap, fundamental for reconstruction[13].

2. DISCUSSION

This review article sums up current information and involvement in piezosurgery, a promising, fastidious, and delicate tissue-saving framework for bone cutting, in light of ultrasonic micro vibrations. The primary advantages of piezosurgery include sensitive tissue preservation, optimal visibility in the surgical field, less blood loss, decreased vibration and noise, increased patient comfort, and assurance of tooth structure. The basic procedures of oral surgery include sinus lift, bone graft harvesting, osteogenic distraction, ridge extension, endodontic surgery, periodontal surgery, inferior alveolar nerve decompression, cyst excision, tooth extraction, and disimpaction.

3. CONCLUSION

Taking everything into account, piezosurgery is a sophisticated bone-cutting technique with a rapidly expanding range of applications in several surgical domains. Piezosurgery provides soft tissue security, optimal visibility in the operative field, minimal blood loss, less vibration, better patient comfort, and tooth structural security. Although expanded working time was expected at first, there is currently adequate proof to reason that this kind of surgical procedure can diminish the absolute working time to where it will be comparable or lower than that of standard methodology. Many components of piezosurgery need improvement, for instance, the cooling framework when the procedure is performed in deep bone designs, and a framework to demonstrate the proximity of the instrument tip to make contact with a major physical structure, soft tissue, or tooth.

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