Content available at: https://www.ipinnovative.com/open-access-journals

IP International Journal of Periodontology and Implantology

Journal homepage: https://www.ijpi.in/

Review Article

Piezosurgery in periodontology

Shamiya Khan[1,*], Manish Khatri[1], Mansi Bansal[1], Mohd. Rehan[1], Pratiksha Tripathi[1], Arti Mishra[1]

[1] *Dept. of Periodontology, Institute of Dental Studies & Technologies, Ghaziabad, Uttar Pradesh, India*

ARTICLE INFO

Article history:
Received 25-04-2023
Accepted 13-06-2023
Available online 29-06-2023

Keywords:
Piezosurgery
Piezosurgery in Periodontology
Ultrasonic device

ABSTRACT

Piezosurgery is a relatively new method derived from the Greek term "piezein" which means "to press tight or to squeeze". Tomaso Vercellotti an italian physician invented it. He teamed up with Mectron Medical Technology, a medical device company was founded by Italian engineers Fernando Bianchetti and Domenico Vercellotti. It is a technique conceived to overcome the limitations of traditional bone cutting instruments in order achieve the most effective treatment with minimal amount of morbidity. It is used for bone removal and bone recontouring procedure on the principle of ultrasonic vibration. Piezoelectric effect generates an electrical charge when subjected to mechanical stress.

1. Introduction

Over the past years dentistry has underwent lots of advancement in day to day life. Various diagnostic imagining technique such as Ultrasonography, Cone Beam Computed Tomography, LASERS, Implants, Microsurgery and Nanotechnology had made the dentistry front runners in the medical field. Traditionally, osseous surgery has been performed with hand instruments (chisel, osteotome or mallet) or various motorized equipment that can be powered by air pressure or electrical energy. Manual hand cutting instruments take much longer time to yield desired results and often difficult to apply in many osseous surgical procedures. Motorized devices have rotary, reciprocal or oscillatory movements that have certain disadvantages such as: necrosis occurs due to overheating of bone tissue; loss of perceptivity to a gentle touch due to pressure on the handpiece; cutting depth is difficult to determine; iatrogenic impairment in undesirable areas due to a failure in the accurate adjustment of the speed of a rotating head or saw; and the risk of soft tissue injury to important anatomical structures such as the inferior alveolar nerve or the maxillary sinus.[1]

2. Objectives

To overcome the limitation of traditional instruments, researchers have surpassed advanced therapeutic devices that function on the idea of ultrasonic microvibrations to cut bone precisely in harmony with the surrounding tissue.[2]

Rationale of the study is to delinate the piezosurgery invention, its indication and contraindication, armamentarium, application of piezosurgery in periodontology and its limitation.

3. Piezosurgery

Piezosurgery is a method used for bone removal and bone recontouring that uses the principle of ultrasonic vibration. The word "piezo" derived from the Greek word piezein which means "to press tight or to squeeze."[3] The Piezoelectric effect is the property of certain materials to

* *Corresponding author*.
E-mail address: kshamiya0@gmail.com (S. Khan).

https://doi.org/10.18231/j.ijpi.2023.020

produce an electrical charge in response to an applied mechanical stress. It was innovated in 1988 by Professor Tomaso Vercellotti and was developed by Mectron Medical Technology.[4] He proposed the idea of using sharpened instruments fitted on ultrasonic device for ablation to perform peri radicular osteotomy to extract an ankylosed tooth. Vercellotti et al. (2000) have revised this method for nerve and soft tissue protecting surgery that has overcame the limitations of traditional instruments in oral bone surgery. Mectron (2000) developed the first generation piezosurgery device.[5,6]

4. Historical Background

Piezoelectrical device was first discovered in 1880 by Jacques and Pierre Curie. They found that applying pressure to different crystals, ceramics, and bone produces electricity. In 1881, Gabriel Lippmann found the converse piezoelectric effect.[7] In 1927, Wood and Loomis explained the physical and biological impacts of high frequency soundwaves.[8] Pohlman used ultrasound on human tissues to treat myalgias and neuropathic pain in 1950.[9,10] In the same year, Maintz demonstrated a beneficial effect on bone regeneration and healing.[11] In 1952, Blamuth introduced an ultrasonic device which was used in dentistry for cavity preparation.[12] Catuna was the first person to use ultrasound in the field of dentistry specifically for preparing dental cavities. This resulted in the introduction of high-speed rotary instruments. In 1955, Zinner introduced the first ultrasonic scalers in periodontal procedures. Richman MJ was the first to disclose the surgical use of an ultrasonic chisel without slurry to remove bone and resect roots in apicoectomies in 1957.[13] Mcfall TA et al in 1961 evaluate distinction of healing by comparing of rotating instruments and oscillating scalpel blades and found a slow healing with no severe complications by use of these scalpel blades.[14] Horton JE et al in 1980 ultrasonic devices improves bone regeneration.[15]

In 1997, Vercellotti was the first who introduced the use of an ultrasonic device for ablation fitted with a sharpened insert, such as a scalpel blade, to perform periradicular osteotomy to extract an ankylosed root of a maxillary canine. Piezosurgery an ultrasound device in 1998 was introduced in medical field by Vercellotti for different procedures such as for hard tissue surgery. In 1999, Tomaso Vercellotti invented Piezoelectric bone surgery in collaboration with Mectron Spa and published about this topic in year 2000.[16]

In 2000, Vercellotti et al. renewed the approach for nerve and soft tissue protecting surgery to overcome the limitations of traditional instruments in oral bone surgery. It was first reported for pre-prosthetic surgery, alveolar crest expansion, and sinus grafting. Mectron developed first generation piezosurgery device in 2000. Vercellotti et al developed a suitable device for routine work in oral surgery that replaced conventional osteotomy instruments in 2001. The first sinus lift and bone block grafting surgeries employing piezosurgery was performed in 2001 and 2002. In 2003, Vercellotti used piezosurgery in animal studies to compare its traumatic impact with that of traditional orthopaedic surgery and reported that it allows for more accurate cuts and a clearer view of the operative field.

In 2004, Mectron introduced Second generation of piezosurgery device. Ultrasonic osteotomy was utilised to relocate the inferior alveolar nerve (IAN) by Bovi in 2005.

The same year first implant site preparation was performed by using piezosurgical device. In the same year, the US Food and Drug Administration extended the use of ultrasonics in dentistry to encompass bone surgeries.[17] In 2006, first ultrasound osteotomy in hand surgery was performed by Hoigne et al.[18] Third generation piezosurgery device was introduced in 2009, and a clean, precise technique of harvesting bone grafts from mandibular ramus was given by Happe A.

5. The Piezosurgical Armamentarium

Piezoelectric devices consists of:

5.1. Main body

Display screen, electronic touchpad, peristaltic pump, stand for handle, and stand for irrigation fluid bag are the constituents of the main body. For selecting the operating mode, particular programme, and coolant flow, the interactive touchpad comprises four keys. Every command is displayed on the screen.[18]

The main unit has three different power levels:[19]

1. Low Mode: It is utilised for orthodontic treatment and apico-endo-canal cleaning procedures
2. High Mode: It is used to clean and smooth the radicular surfaces
3. Boosted Mode: Is used in bone surgeries, osteotomy and osteoplasty procedures.

5.2. Peristaltic pump

Peristaltic pump contains an irrigation solution that flows at an adjustable rate of 0–60 ml/min to cool the cutting area and remove debris. The solution is refrigerated at 4°C to provide a cooling effect, and the volume of liquid can be adjusted with the + and - buttons.

5.3. Hand piece

Piezosurgical device consist of two hand pieces. The handpiece is firmly connected to the cord, which may be sterilised together.[20]

5.4. Handle

The cutting action is based on ultrasonic waves that travelling via piezoelectric ceramic within. These ceramic plates are created by an external generator and alter in volume to produce ultrasonic vibrations. They are channelled into the amplifier, which transmits them to the handle pointed end. A specific key is used to clamp the insert for this function.In this manner, the optimum efficiency for cutting and insert duration is accomplished.[21]

5.5. Foot pedal

Handpiece is controlled by an adjustable pedal on the base.

5.6. Base unit

The power is supplied by the base unit which also have the holder for handpiece and irrigation fluids. The device has display that allows the operator to select between the BONE cutting mode and ROOT operating modes. Using a specific selection for the type or density of the bone, the BONE cutting mode is utilised to cut bone. For endodontic and periodontal root treatments, the ROOT mode is utilised to shape, clean and smooth the root surfaces.

5.6.1. Bone mode

Bone mode are characterized as extremely high ultrasonic power compared to root mode.[22] Its performance is monitored by several advanced software and hardware controls. Due to excessive frequency modulation, mechanical ultrasonic vibration are unique for cutting different kinds of bone.

The selection recommended are:[23]

1. Quality 1: Cutting cortical bone or high density cancellous bone.
2. Quality 3: Cutting low density cancellous bone.

5.6.2. Root mode

The vibrations generated by selecting root mode have an average ultrasonic power without frequency over modulation.[22]

Root operating mode consists of two different programs:[23]

1. Endo program: A limited level of power provided by applying a reduced electrical tension to the transducer, which generates insert oscillation by a few microns. These mechanical micro-vibrations are ideal for irrigating the apical part of the root canal in endodontic surgery.
2. Perio program: An intermediate power level between the endo program and the bone program. The ultrasonic wave is continuosly transmitted through the transducer in a continuous sinusoidal manner, characterized by a frequency equal to the resonance frequency of the insert used.

A special program is designed with a slightly lower standard power than the bone programs has the same frequency over modulation. A special program is dedicated to a limited series of particularly thin and delicate surgical insertstips. These are only recommended for surgeons experienced in piezosurgery and who want an extremely thin and efficient incision.

5.6.3. Inserts tips

The Mectron Medical Technology has developed the design and function of all insert tips used in Piezoelectric bone surgery. Taking into account morphological-functional and clinical factors, the inserts tips have been defined and organized according to a dual classification system.

Various insert tips are classified as:

5.7. According to insert tip coating:[20]

1. Titanium Nitride coated tips are effective in osteoplasty procedure and for harvesting of bone chips as they provide maximum cutting efficiency, resist corrosion and last longer.
2. Diamond coated tips are used for osteotomy of thin bone and/or proximity to anatomic structures.

They are classified as follows:

(a) Sharp Insert tips are designed for maximum cutting efficiency and are used for osteoplasty procedures and to harvest bone chips.
(b) Smooth Insert tips have diamond coated surfaces that enables precise and controlled work on the bone structures. They are used in osteotomy procedures to prepare difficult and delicate structures such as preparation of the sinus window and/or nerve access.
(c) Blunt Insert tips are used for preparing soft tissues, e.g., elevation Schneider's membrane and/or, lateralization of the inferior alveolar nerve. In periodontics, these tips are used for root planing.

5.8. According to insert tip color

1. Gold Insert tips are utilised specifically for bone surgery. The gold color of the insert tips is obtained from the titanium nitride which improves the hardness of the surface for longer working life.[24]
2. Steel Insert tips are used specifically for treating soft tissue and/or delicate tooth structures (roots of teeth).[25]

5.9. Clinical classification

Clinical classification comprises insert tips (sharp, smooth, blunt) based on surgical techniques such as osteotomy,

osteoplasty, extraction.[26]

1. Osteotomy OT - OT1, OT2, OT3, OT4, OT5, OT6, OT7, OT7S4, OT7S3, OT8R/L
2. Osteoplasty OP - OP1, OP2, OP3, OP4, OP5, OP6, OP7
3. Extraction EX - EX1, EX2, EX3
4. Implant site preparation IM - IM1(OP5 -IM2A-IM2P OT4-IM3A-IM3P
5. Periodontal Surgery PS - PS2-OP5-OP3-OP3A- Pp1
6. Endodontic Surgery EN - OP3-PS2-EN1-EN2-OP7
7. Sinus Lift- OP3-OT1-OP5 - EL1-EL2-EL3
8. Ridge Expansion- OT7-OT7S4-OP5- IM1 -IM2-OT4 -Im3
9. Bone Grafting- OT7, OT7S4, OP1, OP5
10. Orthodontic Microsurgery- OT7S4-OT7S3

5.9.1. Indications

1. Implantology:[26]
   (a) Implant site development (socket preparation)
   (b) Splintting and expansion of the alveolar ridge
   (c) Alveolar crest recontouring
   (d) Mental nerve repositioning
   (e) Distraction osteogenesis with subsequent implant placement
   (f) Retrieval of blade implants
   (g) Placement of implants
   (h) Harvesting block grafts
2. Maxillary sinus bone grafting surgery:[26]
   (a) Creating lateral bone window
   (b) Sinus mucosa atraumatic dissection
   (c) Elevation of internal sinus floor elevation
3. Periodontal treatment procedures:[26]
   (a) Supragingival and subgingival scaling
   (b) Irrigation of periodontal pockets
   (c) Crown lengthening
   (d) Soft tissue debribement
   (e) Resective and regenerative surgerical procedure
4. Others:[27]
   (a) Retrograde root canal preparation
   (b) Apicectomy
   (c) Cystectomy
   (d) Extraction
   (e) Tooth extraction with osteogenic distraction Ankylosed tooth
   (f) Extraction
   (g) Orthodontic surgery
   (h) Removal of cyst

5.10. Contraindications[28]

No absolute contraindications

1. Patients or the clinician with electrical implants such as pacemakers.
2. Certain systemic diseases such as cardiovascular diseases, diabetes and bone disease or in patients undergoing radiotherapy, all of which can hinder the dental implant surgery.
3. Alterations that may or may not be related to systemic diseases, bone structure and vascularization.
4. Behaviours such as smoking and excessive drinking.

6. Application of Piezosurgery in Periodontology

6.1. Scaling and root planing

The piezosurgery device is used to remove supragingival and subgingival calculus as well as stains from teeth. It has been discovered that employing cavitation alone without the touch of the vibrating tip is insufficient for removing the calculus; direct contact between the vibrating tip and the calculus is required. The piezosurgery ultrasonic scaler, set to function On/Mode Periodontics (ROOT), with the insert PS1 and PP1, is used for deposit removal on all tooth surfaces for 15 seconds at a medium power of two. Parallel movements were used, with working strokes perpendicular to the tooth axis.[29]

Busslinger et al.[30] conducted a study to compare magnetostrictive and piezoelectric devices and found a substantial difference in time required. The SEM pictures after instrumentation were utilised to compare the four groups. SEM examination of tooth surface roughness revealed that the C100 group had a smoother surface than the C200 group and that the P100 group had a smoother surface than the P200 group, although the difference was not significant. The difference between the C200 and P200 groups was statistically significant. According to Santos et al[31] there were no changes in the results of magnetostrictive and piezoelectric devices uder SEM.

6.2. Curettage

When compared to manual tools, a piezosurgery device is employed for debridement of the epithelial lining of the pocket wall, resulting in microcauterization and removal of root calculus by employing thin tapered tips with an adjusted power setting.[32]

6.3. Clinical crown lengthening

Raising a full-thickness flap, conducting an ostectomy with manual instruments, osteoplasty with a bur for crest bone architecture recontouring, periradicular bone removal, root planing, and ultimately restoring the flap in an apical position are all part of the conventional surgical approach. The crown lengthening procedure done with piezosurgery for successful bone reduction while maintaining root surface integrity.[33,34]

A controlled clinical split mouth study was conducted by Dayoub ST et al[35] to evaluate the clinical results of a minimally invasive flapless method versus an open-flap approach in aesthetic crown lengthening for the treatment of gingival smile up to three months following piezoelectric bone surgery. The study demonstrated that utilising piezosurgery in bone resection is successful with both surgical techniques and resulted in a considerable increase in clinical crown length as compared to baseline. They concluded that the minimally invasive flapless approach and piezosurgery provide alternatives to traditional procedures of aesthetic crown lengthening.

6.4. Resective surgery

In comparision to other instruments, the piezosurgery device is beneficial in periodontal surgery. After the primary flap is raised during resective surgery the device makes it simpler to accompany with the secondary flap and remove the inflammatory granulation tissue. This process results in minor bleeding but by applying the proper ultrasonic vibration, bleeding is prevented.

6.5. Periodontally accelerated orthodontics

Small vertical bone incisions between the teeth were done as part of the periodontally accelerated orthodontics procedure that allows more expedient orthodontic movement. With acceptable levels of pain and discomfort, the corticotomy procedure conducted with a piezosurgical equipment reduce the treatment duration by 60 to 70%. For selective alveolar corticotomies using the Peizosurgical device, surgical control was reported to be simpler than with traditional surgical burs.[36]

6.6. Block harvesting technique

Traditional rotary cutting instruments for bone block harvesting reduce the width of the cortical bone by at least 1 mm circumferentially and are unable to cut the internal cancellous bone effectively. Piezosurgery provides high accuracy and operational sensitivity, as well as simple distinction between cortical and cancellous bone while removing blocks of monocortical cancellous bone.[37]

6.7. Autogenous bone grafting

Due to absence of osteocytes and prevalence of non-vital bone, utilising manual or motor-driven devices for bone surgery may not be suited for grafting. The Piezosurgery inserts tips that are used for bone harvesting process creates a vibration with a width of 60 to 210 in an oscillation controlled module. In contrast to rotary burs or reciprocating saws, the utilisation of ultrasonic vibration creates controlled osteotomies by micrometric bone slices.

6.8. Osteoplasty and bone grafting

Piezosurgical device enables gentle scrubbing of the bone surface in order to obtain appropriate amount of graft material and can be used for gafting infrabony defects.

The function of the bony chips that are obtained vary with size

1. Small size chips aids in early remodelling
2. Larger size chips particles provide mechanical support and act as scaffold for bone growth.

7. Limitations

1. Difficulty to perform the deeper osteotomies.
2. Requires longer time for bone cutting or preparing osteotomy site than traditional cutting instruments.
3. Have longer and different learning curve.
4. Technique sensitive.

8. Conclusion

When compared to traditional rotational devices, ultrasound application to hard tissue is considered a slow procedure. Because it necessitats specialised surgical abilities associated with a certain learning curve. When compared to conventional procedures and soft tissues, piezosurgery is an advanced and conservative approach. Because, device precisely cuts bone, significant nerve damage may be avoided, and minimally invasive operations are conceivable. Using the fine tip enables curved cutting and provides an opportunity for new osteotomy technique. Predictability, Less Postoperative Pain, And Increased Patients Compliance are three P's of piezosurgery.

9. Source of Funding

None.

10. Conflict of Interest

None.

References

1. Manton DJ. Diagnosis of the early carious lesion. *Aus Dent J*. 2013;58(Suppl 1):135–9. doi:10.1111/adj.12048.
2. Rashad A, Kaiser A, Prochnow N, Schmitz I, Hoffmann E, Haurer P, et al. Heat production during different ultrasonic and conventional osteotomy preparations for dental implants. *Clin Oral Implants Res*. 2011;22(12):1361–5. doi:10.1111/j.1600-0501.2010.02126.x.
3. Kshirsagar JT, Kumar PK, Yashodha SR, Maria NT. Piezosurgery: Ultrasonic bone surgery in periodontics and oral implantology. *Int J Appl Dent Sci*. 2015;1(5):19–22.
4. Vercellotti T, De Paoli S, Nevins M. The Piezoelectric Bony Window Osteotomy and Sinus Membrane Elevation: Introduction of a New Technique for Simplification of the Sinus Augmentation Procedure. *Int J Periodontics Restorative Dent*. 2001;21(6):561–7.
5. Bains VK, Mohan R, Bains R. Application of ultrasound in periodontics: Part II. *J Indian Soc Periodontol*. 2008;12(3):55–61. doi:10.4103/0972-124X.44096.

6. Stubinger S, Kuttenberger J, Filippi A, Sader R, Zeilhofer HF. Intraoral piezosurgery: Preliminary results of a new technique. *J Oral Maxillofac Surg*. 2005;63(9):1283–7. doi:10.1016/j.joms.2005.05.304.
7. Babu PF, Polepalle T, Loya M, Deepthi CM, Nayyar AS. Piezosurgery: A Boon to Dentistry. *J Dent App*. 2016;3(4):365–9.
8. Ewen SJ. Ultrasound and Periodontics. *J Periodontol*. 1960;31(2):101–6.
9. Escoda-Francoli J, Rodriguez-Rodriguez A, Berini-Aytes L, Gay-Escoda C. Application of ultrasound in bone surgery: two case reports. *Med Oral Patol Oral Cir Bucal*. 2010;15(6):902–5.
10. Kennedy JE, Haar T, Cranston GR, D. High intensity focused ultrasound: surgery of the future. *Br J Radiol*. 2003;76(909):590–99. doi:10.1259/bjr/17150274.
11. Maintz G. [Animal experiments in the study of the effect of ultrasonic waves on bone regeneration]. *Strahlentherapie*. 1950;82(4):631–8.
12. Sapna N, Vandana K. Ultrasound in periodontics. *Indian J Dent*. 2013;2(3):274–7.
13. Richman MJ. The use of ultrasonics in root canal therapy and root resection. *Med Dent J*. 1957;12:12–8.
14. Mcfall TA, Yamane GM, Burnett GW. Comparison of the cutting effect on bone of an ultrasonic cutting device and rotary burs. *J Oral Surg Anesth Hosp Dent Serv*. 1961;19:200–9.
15. Horton JE, Tarpley TM, Wood LD. The healing of surgical defects in alveolar bone produced with ultrasonic instrumentation, chisel and rotary bur. *Oral Surg Oral Med Oral Pathol*. 1975;39(4):536–46. doi:10.1016/0030-4220(75)90192-9.
16. Vercellotti T. Piezoelectric surgery in implantology: a case report–a new piezoelectric ridge expansion technique. *Int J Perio Rest Dent*. 2000;20(4):358–65.
17. Thomas J. piezoelectric ultrasonic bone surgery: Benefits for the interdisciplinary team and patients. *Dent India*. 2008;2(3):20–4.
18. Hoigne DJ, Stubinger S, Kaenel OV, Shamdasani S, and PH. Piezoelectric osteotomy in hand surgery: First experiences with a new technique. *BMC Musculoskelet Disord*. 2006;12(7):36.
19. Crosetti E, Battiston B, Succo G. Piezosurgery in head and neck oncological and reconstructive surgery: personal experience on 127 cases. *Acta Otorhinolaryngol Ital*. 2009;29(1):1–9.
20. Thomas M, Akula U, Ealla KK, Gajjada N. Piezosurgery: A Boon for Modern Periodontics. *J Int Soc Prev Community Dent*. 2017;7(1):1–7. doi:10.4103/2231-0762.200709.
21. Kamath VK, Pai BJ, Padma R. Piezosurgery-A True Revolution in Periodontics and Implantology. *J Dent Herald*. 2014;1(2):34–7.
22. Vignesh VK, Thamaraiselvan M. Piezoelectric surgery in periodontal therapy. *Res J Pharm Tech*. 2016;9(1):79–82. doi:10.5958/0974-360X.2016.00013.5.
23. Laxmi U, Kaushak S. Piezosugery: unlocking the treasure box. *J Periodontal Med Clin Practice*. 2016;3:80–6.
24. Aro H, Kallioniemi H, Aho AJ, Kellokumpu-Lehtinen P. Ultrasonic Device in Bone Cutting. A Histological and Scanning Electron Microscopical Study. *Acta Orthop Scand*. 1981;52(1):5–10. doi:10.3109/17453678108991750.
25. Lands CA, Stubinger S, Laudemann K, Rieger J, Sader R. Bone harvesting at the anterior iliac crest using piezoosteotomy versus conventional open harvesting: a pilot study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;105(3):19–28. doi:10.1016/j.tripleo.2007.09.025.
26. Yaman Z, Suer BT. Piezoelectric surgery in oral and maxillofacial surgery. *Ann Maxillofac Surg*. 2013;1:1–9.
27. Vercellotti T. Techonological characteristics and clinical indications of piezoelectric bone surgery. *Minerva Stomatol*. 2004;53(5):207–14.
28. Francoli JE, Rodriguez AR, Aytes LB, Escoda CG. Application of ultrasound in bone surgery: Two case reports. *Med Oral Patol Oral Cir Bucal*. 2010;15(6):902–5.
29. Newman MG, Takei HH, Klokkevold PR, Carranza F. Technologic Advances in implant surgery: Piezoelectric Bone Surgery;. p. 1131–45.
30. Busslinger A, Lampe K, Beuchat M, Lehmann B. A comparative in vitro study of a magnetostrictive and a piezoelectric ultrasonic scaling instrument. *J Clin Periodontol*. 2001;28(7):642–9. doi:10.1034/j.1600-051x.2001.028007642.x.
31. Santos FA, Pochapski MT, Leal PC, Gimenes-Sakima PP, Marcantonio E. Comparative study on the effect of ultrasonic instruments on the root surface in vivo. *Clin Oral Investig*. 2008;12(2):143–50. doi:10.1007/s00784-007-0167-3.
32. Hema S, Kranti K, Sameer Z. Piezosurgery in periodontology and oral implantology. *J Indian Soc Periodontol*. 2009;13(3):155–6. doi:10.4103/0972-124X.60229.
33. Beziat JL, Vercellotti T, Gleizal A. What is Piezosurgery? Two years experience in craniomaxillofacial surgery. *Rev Stomatol Chit Maxillofac*. 2007;108(2):101–7.
34. Devi S, Swaminathan M, Karthikeyan I. Anitha K; Peizo surgery in periodontics. *Int J Prsthodont Restor Dent*. 2015;5(2):51–5.
35. Dayoub ST, Yousef MA. Aesthetic Crown Lengthening with Flapless Piezoelectric Surgery in Comparison with Traditional Open Flap Approach. *J Clin Diagn Res*. 2019;13(8):24–8.
36. Landes CA, Stübinger S, Ballon A, Sader R. Piezoosteotomy in orthognathic surgery versus conventional saw and chisel osteotomy. *Oral Maxillofac Surg*. 2008;12(3):139–47.
37. Sohn DS, Ahn MR, Lee WH, Yeo DS, Lim SY. Piezoelectric osteotomy for intraoral harvesting of bone blocks. *Int J Periodontics Restorative Dent*. 2007;27(2):127–31.

Author biography

Shamiya Khan, Post Graduate

Manish Khatri, HOD

Mansi Bansal, Professor https://orcid.org/0000-0001-6930-7439

Mohd. Rehan, Reader

Pratiksha Tripathi, Senior Lecturer https://orcid.org/0000-0002-0195-5541

Arti Mishra, Post Graduate

Cite this article: Khan S, Khatri M, Bansal M, Rehan M, Tripathi P, Mishra A. Piezosurgery in periodontology. *IP Int J Periodontol Implantol* 2023;8(2):97-102.