Knowledge, Attitude and Practice of Piezo Surgery among General Practitioners in Chennai

Aathira C M¹, Vinay Sivaswamy*²

¹Saveetha Dental College & Hospital, Saveetha Institute of Medical & Technical Sciences, Chennai, Tamil Nadu
²Department of Prosthodontics, Saveetha Dental College & Hospital, Saveetha Institute of Medical & Technical Sciences, Chennai, Tamil Nadu

Article History:
Received on: 20 Aug 2020
Revised on: 20 Sep 2020
Accepted on: 25 Sep 2020

Keywords:
Piezosurgery, Cavitation, Implants, Awareness

ABSTRACT

Dentistry over a decade has undergone many significant advancements and has led to the evolution in various facilities in order to provide better and comfortable treatment to the patients. One among which piezosurgery is a novel innovation that contributes to the bone surgery and fulfills both biological and Technical criteria. It is a soft tissues bearing system for bone procedures with the use of low-frequency micro-vibrations. The survey was conducted online using google sheets, and a questionnaire consisting of 12 questions were circulated among 100 people of Chennai district. The responses were compiled and analysed using the statistical package in google sheets. Based on the results obtained, it can be concluded that the general practitioners of India are unaware about piezosurgery and its applications.

*Corresponding Author
Name: Vinay Sivaswamy
Phone: 9176923110
Email: vinay.sdc@saveetha.com

ISSN: 0975-7538
DOI: https://doi.org/10.26452/ijrps.v11iSPL3.3360

INTRODUCTION

The success of any treatment in dentistry is determined by the tools used for it (Rashad et al., 2011; Ariga et al., 2018). Hand and rotary instruments were used for bone surgeries traditionally. These techniques had their own caveats of uncontrolled force and heat generation, respectively. Uncontrolled force for bone cutting results in fractures or involvement of vital structures occasionally. Excessive heat generated by rotary instruments results in bone necrosis and subsequent therapeutic failure (Konuganti et al., 2009; Jyothi et al., 2017).

Now with the evolution of Piezosurgery, there is an opportunity to avoid iatrogenic damage and simultaneously provide a field of painless dentistry. This method uses ultrasonic micro-vibrations of low-frequency that ranges from 25 to 30 kHz which enables only the bone to be cut without any damage to the adjacent soft tissues (Seoane et al., 2013; Yaman and Suer, 2013; Duraisamy et al., 2019).

There have been studies which compared piezosurgery with the traditional bone surgery and the tools used and enlightens the mechanism of action tools used biological effects and advantages and disadvantages and also about the applications of piezosurgery in dentistry (Toke et al., 2017; Selvan and Ganapathy, 2016). Piezosurgery works based on the principle of pressure. In this technique, the mechanical energy is converted into electrical energy in the form of tension and compression. The pressure on the handpiece must not be expressive as it decreases oscillations which reduces the cutting ability (Vercellotti, 2004; Ganapathy et al., 2016).

Cavitation is an important step which involves vaporization bubble formation and disintegration into fragments of original size due to decrease in pressure. The oscillating tip supply school and so as
to produce a Cavitation effect (Stübinger et al., 2015; Subasree et al., 2016). Piezoelectric devices cause micrometric cutting, selective cutting, asepsis, Cavitation and minimal surgical stress (Aro et al., 1981; Ranganathan et al., 2017) The piezoelectric device consists of a handpiece, base unit, foot pedal, main power unit, control panel which has four buttons. It helps to control the speed of the irrigants (Gleizal et al., 2007; Vijayalakshmi and Ganapathy, 2016)

The application of Piezosurgery ranges from minor procedures to complicated surgeries. It has been used in various specialties of dentistry such as oral and maxillofacial surgery for traumatic tooth restoration, graft harvesting in the form of chips and blocks, management of TMJ ankylosis, and so forth (Robert et al., 2008; Jain and Dhanraj, 2016). It has applications in the field of dental implantology for procedures such as socket preparation, mobilization of IA nerve and in complicated procedures such as alveolar ridge expansion and sinus elevation to separate the palatal and vestibular bone and avoid membrane perforation (Wagenberg and Froum, 2010; Desai et al., 2020). It has also been applied in the field of periodontics for osteoplasty, osteotomy and regenerative surgery. (Walmley et al., 1992; Bokadia et al., 2018). With the advent of comprehensive yet evidence based care in dentistry, it appears that piezosurgery can provide a safe and predictable solution for procedures involving bone resection. Therefore, it is imperative that general dental practitioners possess a working knowledge of piezosurgery and its applications to provide a safe modicum of care to their patients. The aim of this study therefore, is to assess the knowledge of general practitioners in an urban city of Tamil Nadu (Chennai) regarding piezosurgery.

MATERIALS AND METHODS

A cross-sectional questionnaire survey was conducted among 100 General Dental Practitioners in Chennai, Tamil Nadu, India during April 2020. A Questionnaire comprising 16 questions about the working mechanism and applications of piezosurgery were sent to these practitioners using the google forms survey platform and disseminated online through Whatsapp instant messaging application. The responses were compiled using google sheets, and the data was statistically analysed using the same software.

RESULTS AND DISCUSSION

Figure 1 represents the applications of Piezosurgery in periodontal surgeries for which 47 % has responded that it only contributes to Crown lengthening and the rest divided between osteotomy and regenerative surgery. The crown lengthening is performed with piezosurgery with appropriate inserts to reduce bone loss and preserve the root surface (Sherman and Davies, 2000; Shivakthy, 2013). All three modalities of treatment can be performed with piezosurgery with relative ease. (Ashok et al., 2014) A higher number of responses (47%) have been recorded that the application of piezosurgery in periodontal surgeries was crown lengthening. Only 16% of respondents stated it as regenerative surgery, followed by osteotomy (12%) and lastly, all of the above (25%).
Figure 4: Pie Chart indicating the frequency distribution of responses to the biological effects of piezosurgery on bone.

Figure 5: Pie Chart indicating the frequency distribution of responses the use of smoothening inserts to prepare delicate structures.

Figure 6: Pie Chart indicating the frequency distribution of responses to the use of blunt inserts.

Figure 7: Pie chart indicating the frequency distribution of responses to the use of piezosurgery for atraumatic tooth extraction.

Figure 8: Pie chart indicating the frequency distribution of response to the use of piezosurgery in sinus lift procedure.

Figure 9: Pie chart indicating the frequency distribution of response to the complications overcome by piezosurgery in implantology procedures.

Figure 10: Pie chart indicating the frequency distribution of response to the advantages of piezosurgery.

Figure 11: Pie chart indicating the frequency distribution of response to the disadvantages of piezosurgery.
Figure 12: To the drawbacks overcome by piezosurgery when compared with the conventional rotary cutting technique.

Figure 13: Association between the responses for Piezosurgery mechanism and the effect of Piezosurgery for Atraumatic tooth extractions.

Figure 14: Association between the responses for Piezosurgery mechanism and the use of Piezosurgery for Sinus lift procedures.

Figure 15: Association between responses for the Piezosurgery mechanism and the use of Piezosurgery for periodontal surgeries.

There is adequate scientific literature proving that the degree of mineralization, insert design and pressure on the handpiece determines the cutting efficiency. Therefore, planning the procedure in accordance with bone density plays a major role in determining the duration of the procedure and the shelf life of the insert. Of the responses recorded, the majority of the responses recorded the degree of mineralisation as the dependent factors of the cutting efficiency of piezosurgery (66%), while 14% stated it as pressure on the hand-piece and only 7% stated pressure on the handpiece. Lastly, 13% stated that either of these was not the dependent factors of the cutting efficiency.

Figure 3 reveals that 45% have responded that the phenomenon of cavitation acts as a coolant in periodontal surgeries while others chose the response of minimal bleeding. Cavitation actually facilitates effective scaling debridement and root planing as in piezoelectric scaler tips (Carr and Wykes, 1993; McDonald, 1998). A majority of the responses recorded that cavitation acts as a coolant (45%), only 16% have been recorded as facilitated effective scaling, followed by debridement (26%) and lastly, minimal bleeding (13%).

Figure 4 reveals that 44 percentage hypothesised the presence of live osteocytes as the biological effect of piezosurgery. The biological effects are no cellular swelling, and few live osteocytes are seen (Robiony et al., 2004; Ajay et al., 2017). A majority of the responses have recorded the presence of live osteocytes (44%), 22% of the responses said that no lesions are seen in the mineralised tissues, whereas no cellular suffering (15%) and 19% answered all of the above.

Figure 5 shows that more than 80 % has agreed that smoothening inserts are used to prepare the difficult and delicate structures which is routine in piezo practice (Wallace et al., 2008). A majority of the responses have recorded smoothening inserts are used to prepare delicate and difficult structures (86%) while the rest did not agree with the same (14%).

Figure 6 shows that 55 percent has responded that the characteristic feature of the blunt insert is not having a blunt and cutting tip. An opposing article states that plant and cutting tips is a feature
of Blunt inserts (Ashok and Suvitha, 2016). Of the responses recorded, 55% answered blunt and cutting tip, atraumatic elevation (11%), grafting procedure (31%) and only 3% felt that blunt inserts are used for bone shaping.

Figure 7 shows that 62% of the respondents agreed that piezosurgery is a painless surgery with faster bone healing in a traumatic extraction which is a proven effect of piezoelectric tips on bone (Kafel et al., 2014). Of the responses recorded, 28% have recorded it as painless surgery, 7% answered it as painless surgery whereas 62% have responded that both contribute to the use of piezosurgery for atraumatic tooth extraction and only 3% opposes with the other results.

Figure 8 indicates that 60% of the respondents are of the notion that piezosurgery prevents damage to the adjacent structure in the sinus lift procedure. The biggest advantage of piezosurgery is the reduced risk of membrane perforations with an incidence of 30% with Rotary instruments and only 7% with piezosurgery. A majority of the responses have recorded that piezosurgery does not damage the adjacent structure in sinus lift procedure (60%) followed by reduces the risk of membrane perforations (16%), does not damage the Schneiderian membrane (14%) and lastly 10% responded that neither of it is the use of piezosurgery in sinus lift procedure.

Figure 9 shows that 34% agreed that piezosurgery in implant procedures reduces complications like membrane perforations, intraoperative bleeding and surgical trauma. The same results were obtained and shown in prior literature (Kannan et al., 2017). Of the responses recorded, 29% answered membrane perforations was the complication overcome by piezosurgery in implantology procedures, intraoperative bleeding (14%), surgical trauma (23%) and 34% responded that all of the above was the complications overcome by piezosurgery in implantology procedures.

Figure 10 shows that 49% have responded that reduced bone necrosis is seen in the case of Piezosurgery, and so is considered as an advantage of piezosurgery. Other advantages are the lack of drill noise, fast healing, reduced risk of emphysema (Aranda-Narváez et al., 2014; Venugopalan et al., 2014). A majority of the responses recorded no bone necrosis (49%), cuts only the hard tissue (27%), hemostatic effect of surrounding tissue (14%) and lastly, 10% responded that neither of the above was the advantage of piezosurgery.

Figure 11 shows that 55% of the respondents responded that the major disadvantage with the piezosurgery is that it has increased operating time. There are studies which recommend a longer operating duration when using piezo tips (Labanca et al., 2008; Kannan and Venugopalan, 2018). Of the responses recorded, 55% have recorded increased operating time, 16% have recorded lessening of the risk of damaging the soft tissues, followed by 8% answered both of the above and 21% responded that they have no idea on the advantages of piezosurgery.

Figure 12 reveals that 50% of respondents agree that piezosurgery has reduced the risk of bone loss which is a scientifically proven fact (Agarwal et al., 2014; Basha et al., 2018). A majority of the respondents have recorded increased bone loss (50%) whereas reduced heat generation (27%) followed by less noise during procedure (13%) and lastly, high external irrigation (10%).

The results presented above show that the approximately half of the participating practitioners are aware of the applications whereas the rest hypothesise there are advantages but are not certain of the specifics of the mechanism or effectiveness of the piezosurgery method. Piezosurgery has proven to be one of the most atraumatic methods of bone resection when used for graft harvesting, sinus lifts and osteotomies. It has been the subject of most current research projects involving bony surgeries for dental therapy. Since it is a recent topic of interest, there has been only minimal notification on its effectiveness among the majority of general dental practitioners. The results obtained in this survey show that more dental practitioners need to be made aware of the beneficial effects of piezosurgery so that the method can be implemented in routine clinical protocol to provide a safe, painless and predictable outcome for patients.

Figures 13, 14 and 15 reveals that practitioners associate the use of piezosurgery with successful outcomes in sinus lift surgeries, atraumatic extractions and periodontal surgeries (p<0.05). This trend reveals that while practitioners are aware of piezosurgery and in part, its mechanism of action, they are not aware of the actual effects of the technique in surgical procedures. All associations indicate that practitioners are aware of the beneficial effect of the piezosurgery technique in these procedures. Chi-square test was performed to evaluate if practitioners were able to determine that the piezosurgery unit can result in atraumatic extractions. Pearson Chi-square value - 25.801; p = 0.002. The responses provided by the practitioners had a positive association (p<0.05) between the piezosurgery mechanism and the outcome of atraumatic extractions with the highest responses leaning to the belief that
it results in painless procedures and faster bone healing. Chi-square analysis was performed to evaluate if practitioners were able to determine that the piezosurgery unit can provide positive outcomes for sinus lifts. Pearson Chi-square value - 21.054; p = 0.012. The responses provided by the practitioners had a positive correlation (p<0.05) between the piezosurgery mechanism and the outcome of sinus lift procedures with the highest responses leaning to the belief that it helps prevent damage to adjacent structures. Chi-square test was performed to evaluate if practitioners were able to determine the role of piezosurgery for periodontal surgery. Pearson Chi-square value - 17.626; p = 0.040. The responses provided by the practitioners had a positive association (p<0.05) between the piezosurgery mechanism and its usage in periodontal surgical procedures. The highest number of responses associated with the cutting action of the piezosurgery unit also acting as a coolant with reduced heat generation.

Limitations
The limitation of this article is that the survey was conducted with a small sample size of only a hundred general practitioners. The results are hence only representative of a select group of the dental fraternity and cannot be extrapolated to the entire dental practitioner community.

Future scope
Even though the current data is inadequate in being applicable to the dental community in this locale, the same data shows a trend of selective awareness among these practitioners. This trend raises questions on the knowledge and awareness of the rest of the dental fraternity and hence, this same study could be repeated on a bigger set of the dental practitioner populace. Raising awareness on this topic could help in the widespread implementation of this method which increases patient comfort and treatment success.

CONCLUSIONS
Based on the results obtained, it can be concluded that the majority of the population are partly aware about the role of piezosurgery in dentistry. Piezosurgery has wide applications along with the added advantage of predictable safety in the field of dentistry. Awareness on this modicum of care can be raised by including this procedure as part of the course curriculum in dental schools and also by implementing training workshops for general dental practitioners as well as conducting awareness programs by public health dental groups.

Conflict of Interest
The authors declare that they have no conflict of interest for this study.

Funding Support
The authors declare that they have no funding support for this study.

REFERENCES
Agarwal, E., Masamatti, S. S., Kumar, A. 2014. Escalating role of piezosurgery in dental therapeutics. Journal of clinical and diagnostic research, 8(10).
Ajay, R., Suma, K., Ali, S., Sivakumar, J. K., Rakshagan, V., Devaki, V., Divya, K. 2017. Effect of surface modifications on the retention of cement-retained implant crowns under fatigue loads: An In vitro study. Journal of Pharmacy And Bioallied Sciences, 9(5):154–154.
Aranda-Narváez, J. M., González-Sánchez, A. J., Montiel-Casado, M. C., Titos-García, A., Santoyo-Santoyo, J. 2014. Acute necrotizing pancreatitis: Surgical indications and technical procedures. World Journal of Clinical Cases: WJCC, 2(12):840–840.
Arima, P., Nallaswamy, D., Jain, A. R., Ganapathy, D. M. 2018. Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review. World Journal of Dentistry, 9(1):68–75.
Aro, H., Kallioniemi, H., Aho, A. J., Kellokumpu-Lehtinen, P. 1981. Ultrasonic Device in Bone Cutting: A Histological and Scanning Electron Microscopical Study. Acta Orthopaedica Scandinavica, 52(1):5–10.
Ashok, V., Nallaswamy, D., Begum, S. B., Nesappan, T. 2014. Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report. The Journal of Indian Prosthodontic Society, 14(S1):279–282.
Ashok, V., Suvitha, S. 2016. Awareness of all ceramic restoration in rural population. Research journal of Pharmacy and Technology, 11(6):2565–2565.
Basha, F. Y. S., Ganapathy, D., Venugopalan, S. 2018. Oral Hygiene Status among Pregnant Women. Research journal of Pharmacy and Technology, 11(7):3099–3099.
Bokadia, G. S., Brundha, M. P., Ariga, P. 2018. Current knowledge about lung cancer among middle-aged non medical males a questionnaire based survey. Research Journal of Pharmacy and Technology, 11(6):2565–2565.
Carr, H., Wykes, C. 1993. Diagnostic measurements in capacitive transducers. Ultrasonics, 31(1):13–20.
Desai, A., Dabak, S., Shah, R., Mitra, D. K. 2020. Assessment of the awareness and knowledge among practising dentists and general physicians about prescription writing: A survey. Journal of Indian Dental Association, 14(3).

Duraisamy, R., Krishnan, C. S., Ramasubramanian, H., Sampathkumar, J., Mariappan, S., Sivaprasakas, A. N. 2019. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant dentistry, 28(3):289–295.

Ganapathy, D., Sathyamoorthy, A., Ranganathan, H., Murthykumar, K. 2016. Effect of resin bonded lingating agents influencing marginal discrepancy in all ceramic complete veneer crowns. Journal of Clinical and Diagnostic Research, 10(12).

Gleizal, A., Bera, J.-C., Lavandier, B., Beziat, J.-L. 2007. Piezoelectric osteotomy: a new technique for bone surgery—advantages in craniofacial surgery. Child's Nervous System, 23(5):509–513.

Jain, A. R., Dhanraj, M. 2016. A Clinical Review of Spacer Design for Conventional Complete Denture. Biology and Medicine, 8(5).

Jyothi, S., Robin, P. K., Ganapathy, D., Anandivelvaraj 2017. Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture. Research Journal of Pharmacy and Technology, 10(12):4339–4339.

Kafel, N., Kolodziejski, J., Niemiera, M., Reed, M. 2014. Separation of the periodontal ligament for atraumatic tooth extraction. 40th Annual Northeast Bioengineering Conference (NEBEC), pages 1–2.

Kannan, A., M, G. D., S, V. 2017. Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis. World, 8(6):496–502.

Kannan, A., Venugopalan, S. 2018. A systematic review on the effect of use of impregnated retraction cords on gingiva. Research Journal of Pharmacy and Technology, 11(5):2121–2121.

Konuganti, K., Zope, S., Seshan, H. 2009. Piezosurgery in periodontology and oral implantology. Journal of Indian Society of Periodontology, 13(3):155–155.

Labanca, M., Azzola, F., Vinci, R., Rodella, L. F. 2008. Piezoelectric surgery: Twenty years of use. British Journal of Oral and Maxillofacial Surgery, 46(4):265–269.

Mcdonald, F. 1998. Stopping the rot: fluoride in Nepal's drinking water-a pilot study. J Nep Med Assoc, 37:494–501.

Ranganathan, H., Ganapathy, D. M., Jain, A. R. 2017. The cervical and incisal marginal discrepancy in ceramic laminate veneering materials: a SEM analysis. Contemporary clinical dentistry, 8(2):272–278.

Rashad, A., Kaiser, A., Prochnow, N., Schmitz, I., Hoffmann, E., Maurer, P. 2011. Heat production during different ultrasonic and conventional osteotomy preparations for dental implants. Clinical Oral Implants Research, 22(12):1361–1365.

Robert, J., Herndon, M., D, M. 2008. Editor Emeritus. International Journal of MS Care, 10(2).

Robiony, M., Polini, F., Costa, E., Vercellotti, T., Politi, M. 2004. Piezoelectric bone cutting in multipiece maxillary osteotomies. Journal of Oral and Maxillofacial Surgery, 62(6):759–761.

Selvan, S. R., Ganapathy, D. 2016. Efficacy of fifth generation cephalosporins against methicillin-resistant Staphylococcus aureus-A review. Research Journal of Pharmacy and Technology, 9(10):1815–1815.

Shivanth, J., López-Niño, J., García-Caballero, L., Seoane-Romero, J. M., Tomás, I., Varela-Centelles, P. 2013. Membrane Perforation in Sinus Floor Elevation - Piezoelectric Device versus Conventional Rotary Instruments for Osteotomy: An Experimental Study.

Sherman, J. A., Davies, H. T. 2000. Ultracision®: the harmonic scalpel and its possible uses in maxillofacial surgery. British Journal of Oral and Maxillofacial Surgery, 38(5):530–532.

Shivasakthy, M. 2013. Comparative Study on the Efficacy of Gingival Retraction using Polyvinyl Acetate Strips and Conventional Retraction Cord – An in Vivo Study. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH, 7(10):2368–2368.

Stübinger, S., Stricker, A., Berg, B.-I. 2015. Piezosurgery in implant dentistry. Clinical, Cosmetic and Investigational Dentistry, 7:115–115.

Subasree, S., Murthykumar, K., Dhanraj 2016. Effect of Aloe Vera in Oral Health-A Review. Research Journal of Pharmacy and Technology, 9(5):609–609.

Toke, N., Thomas, R., Panackel, C., Sebastian, B., Mathai, S. 2017. Microbiological Profile of Spontaneous Bacterial Peritonitis in Patients With Liver Cirrhosis in South India. Clinical Gastroenterology and Hepatology, 15(1):157–157.

Venugopalan, S., Ariga, P., Aggarwal, P., Viswanath, A. 2014. Case Report: Magnetically retained silicone facial prosthesis. Nigerian Journal of Clinical
Practice, 17(2):260–264.

Vercellotti, T. 2004. Technological characteristics and clinical indications of piezoelectric bone surgery. Minerva stomatologica, 53(5):207–207.

Vijayalakshmi, B., Ganapathy, D. 2016. Medical management of cellulitis. Research Journal of Pharmacy and Technology, 9(11):2067–2067.

Wagenberg, B. D., Froum, S. J. 2010. Implant complications related to immediate implant placement into extraction sites, Dental Implant Complications. Etiology, Prevention and Treatment, pages 325–340.

Wallace, S. S., Taschieri, S., Trisi, P., Fabbro, M. 2008. New technique for large sinus membrane perforation repair. Journal of Cranio-Maxillo-Facial Surgery, 36(219):206.

Walmsley, A. D., Laird, W. R. E., Lumley, P. J. 1992. Ultrasound in dentistry. Part 2—periodontology and endodontics. Journal of Dentistry, 20(1):11–17.

Yaman, Z., Suer, B. T. 2013. Piezoelectric surgery in oral and maxillofacial surgery. Annals of Oral and Maxillofacial Surgery, 1(1).