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

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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.

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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 specialities 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 (Walmsley *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; Shivasakthy, 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%).

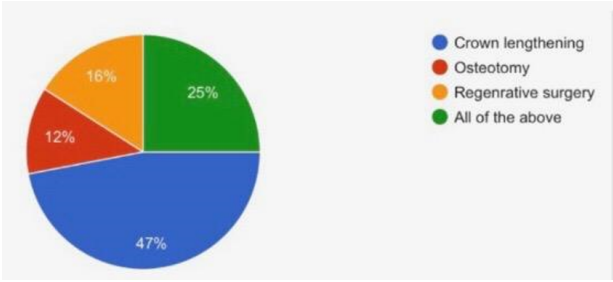

Figure 1: Pie Chart indicating the frequency distribution of responses procured as to whether respondents had an idea on the applications of piezosurgery in periodontal surgeries.

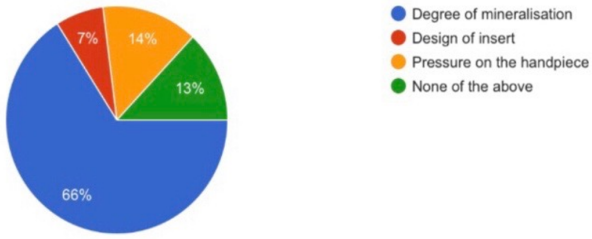

Figure 2: Pie chart indicating the frequency distribution of responses to the dependent factors of the cutting efficiency of piezosurgery.

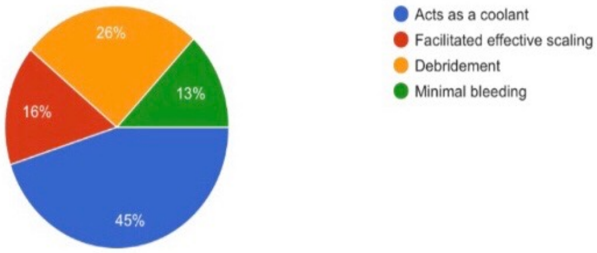

Figure 3: Pie Chart indicating the frequency distribution of responses the role of cavitation in piezosurgery.

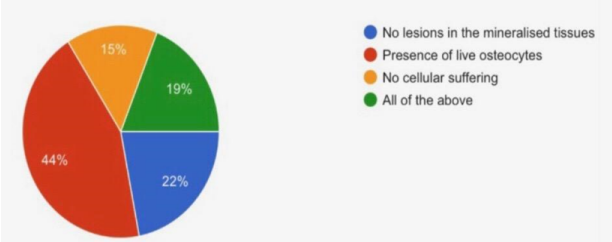

Figure 4: Pie Chart indicating the frequency distribution of responses to the biological effects of piezosurgery on bone.

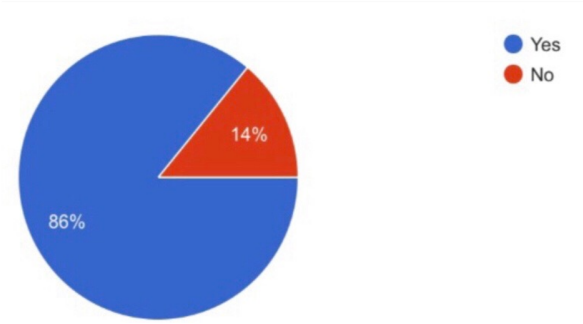

Figure 5: Pie Chart indicating the frequency distribution of responses the use of smoothening inserts to prepare delicate structures.

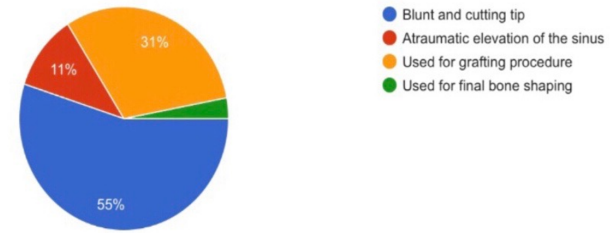

Figure 6: Pie Chart indicating the frequency distribution of responses to the use of blunt inserts.

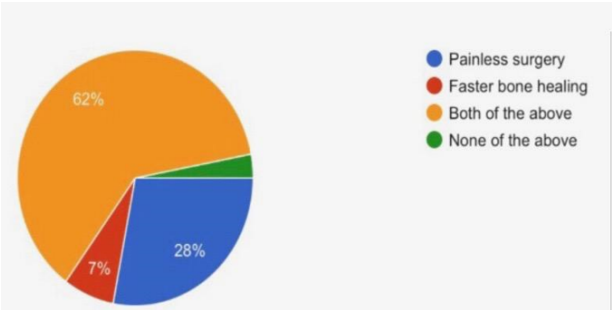

Figure 7: Pie chart indicating the frequency distribution of responses to the use of piezosurgery for atraumatic tooth extraction.

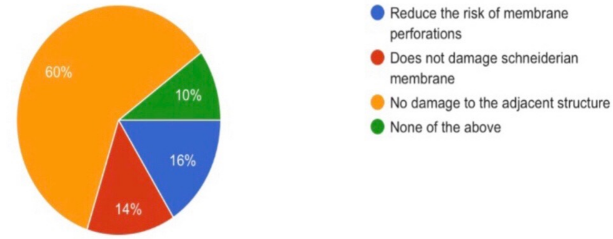

Figure 8: Pie chart indicating the frequency distribution of response to the use of piezosurgery in sinus lift procedure.

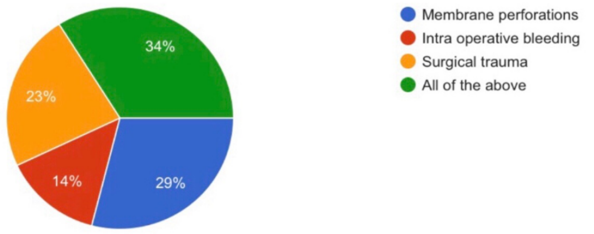

Figure 9: Pie chart indicating the frequency distribution of response to the complications overcome by piezosurgery in implantology procedures.

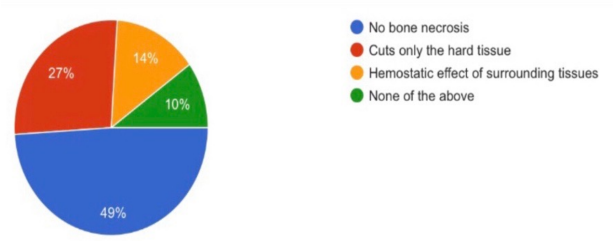

Figure 10: Pie chart indicating the frequency distribution of response to the advantages of piezosurgery.

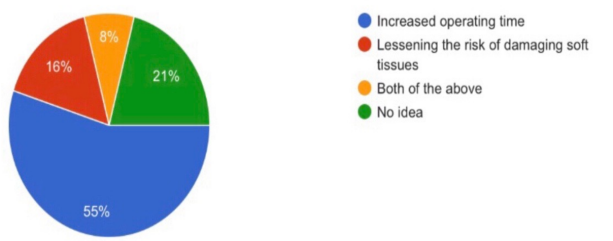

Figure 11: Pie chart indicating the frequency distribution of response to the disadvantages of piezosurgery.

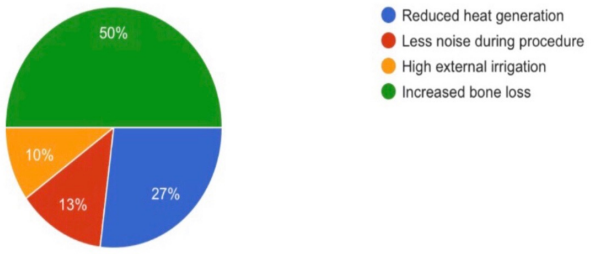

Figure 12: To the drawbacks overcome by piezosurgery when compared with the conventional rotary cutting technique.

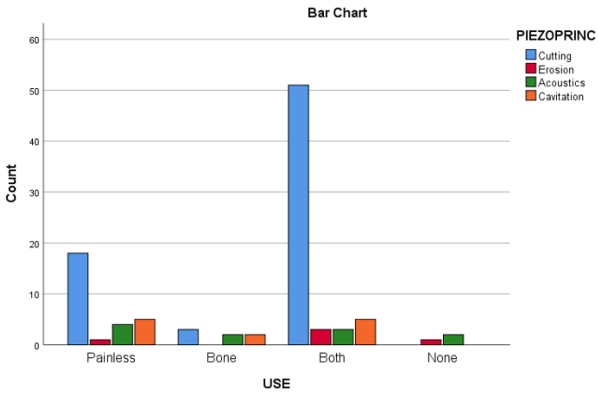

Figure 13: Association between the responses for Piezosurgery mechanism and the effect of Piezosurgery for Atraumatic tooth extractions.

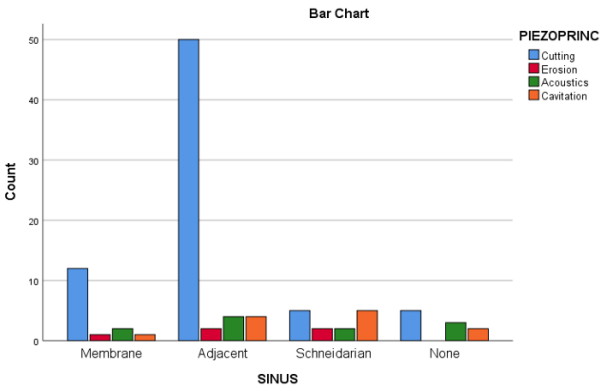

Figure 14: Association between the responses for Piezosurgery mechanism and the use of Piezosurgery for Sinus lift procedures.

Figure 2 indicates that 66 % has responded that the degree of mineralization decides the cutting efficiency of piezoelectric device. 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

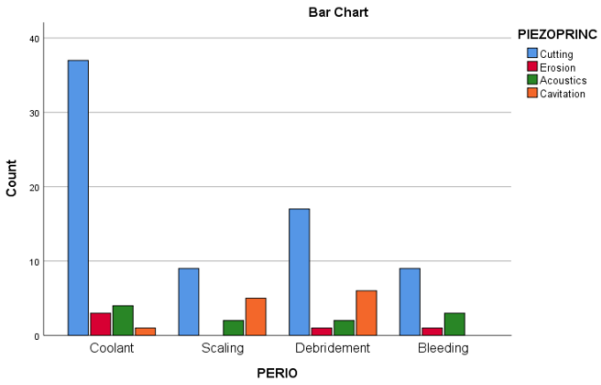

Figure 15: Association between responses for the Piezosurgery mechanism and the use of Piezosurgery for periodontal surgeries.

recorded the degree of mineralisation as the dependent factors of the cutting efficiency of piezosurgery (66%), while 14% stated it as pressure on the handpiece 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 percentage 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 percentage 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 operatory 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 percentage 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 mech-

anism 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.

Limitation

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.

CONCLUSION

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.

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