



Knowledge, Attitude & Practice of Ultrasonic Bone Surgery (Piezo electric) among Dentists in the State Tamilnadu- KAP Study

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Authors' contributions

This work was carried out in collaboration among all authors. Author RAJC designed the study, Author KR performed the statistical analysis, Author AU wrote the protocol, Author SPR managed the analysis of the study, Author JKK and JAK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background:

Objectives: To assess the knowledge, attitude, practice of Ultrasonic bone surgery (piezo electric) among dentist in the state of Tamilnadu.

Methods: A set of 29 questions was sent to dentists in and around Tamilnadu. The questionnaire was circulated digitally (Google forms & emails) and responses were recorded. 125 dentists participated in the study, among them 21 dentists were excluded since they did not have any awareness about piezo surgery or the equipment used.

Statistical Analysis: The basic data was expressed used using frequency with percentages and by diagrams. For expressing quantitative variable, mean and standard deviation were used. Kruskal wallis test was used to compare whether knowledge score differed by characteristics of the

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selected variables and Dunn's post hoc test was applied to find out which of the characteristics were statistically significant. All the statistical analysis were done using XLSTAT 2014 software

Results: 63% of the dentists had adequate knowledge regarding piezo surgery and 53% of the dentists were currently using piezotome in their dental practice and 47% of dentists use it for harvesting bone grafts and 86% have complimented that it was less traumatic to the hard tissues. 81% felt that patient compliance was better compared to traditional methods like osteotome and chisel. Majority of the dentists showed a positive attitude towards piezosurgery and they extended their willingness to update their knowledge furthermore and emphasized that the concept of piezosurgery, its usage and its advantages should be given adequate importance in future dental education.

Conclusion: This study demonstrated that knowledge and attitude towards piezosurgery was good among the dental professionals, but the actual practice of it is still deficient. This could be probably because of the lack of training in the dental schools, which could be overcome by including piezo surgery in dental curriculum and conducting workshops for improvising the skill of the dentists.

Keywords: Piezosurgery; implant surgery; periodontal surgery; piezotome.

1. INTRODUCTION

Alveolar bone loss in periodontitis is the major cause for tooth loss. Prevention and augmentation of lost bone plays a major role in retaining original teeth or better placement of the future dental prosthesis. Techniques which have been used to improve the available alveolar bone either from adjacent areas or distant areas intra-orally [1]. Piezoelectric surgery using piezotome is one of the recent techniques to harvest autogenous bone with less discomfort and limited morbidity to the donor site [2].

1.1 Advantages

The advantages of using piezosurgery are it is minimally invasive [3], fastidious for hard tissue cutting [4] which causes adequate haemostasis, enhancing tissue healing, increased comfort and safety to the patient and thus promoting decreased post-operative pain and swelling compared with the traditional methods (manual & rotary). The benefits of piezotome are surgical precision and predictability which increases treatment effectiveness. The added benefits of piezotome are selective and micrometric cutting action, maximum intra-operative visibility brought by light emitting diode (LED) and cavitation effect, sterile irrigation system, and preservation of vital structures (Neurovascular bundle and Schenederian membrane [5]) are the added benefits of using piezotome.

Piezosurgery device frequency ranges between 25–29 kHz and a linear vibration ranging from 60–200 μm and the power is approximately 5 W. Three power levels can be used in dentistry

where the higher mode is for cleaning and smoothing of the radicular surface of the root canal, the Low mode is for apical portion of the root canal as well as for orthodontic surgery. Osteotomy and osteoplasty can be performed using boosted mode [6].

It has a wide variety of clinical applications in dentistry, and especially in Periodontics, for supra and subgingival calculus removal [7], in crown lengthening [8], Harvesting autologous bone graft [9], Implant site preparation, alveolar ridge split, Expansion and recontouring, preparation of bone window laterally for Maxillary sinus Elevation and Nerve repositioning. Even piezosurgery has got so many advantages in the field of dentistry, most of the dentists do not practice it due to the lack of Knowledge and awareness.

The following are the common Disadvantages of piezoelectric device [6]:

1. Patients with pacemakers and cardiopathy cannot be treated with piezosurgery device.
2. Excessive pressure may turn into heat resulting in delayed healing,
3. Piezosurgery to be avoided near Metal and porcelain fused metal crowns.
4. Very expensive.

Limitations of Piezoelectric unit:

The device is technique sensitive.

Increase in operative time.

Insert tips gets worn out very rapidly.

The device is more expensive when compared with regular cutting instruments.

2. MATERIALS AND METHODS

2.1 Study Design

This study was designed and conducted as a multiple-choice questionnaire based cross sectional survey to assess the knowledge, attitude and practicing trends towards piezosurgery among general dentists practicing in and around Tamilnadu. The approval for this study was obtained from the human institutional ethics committee of Sri Venkateswara dental college & hospital, Chennai. The duration of the study was 3 months, from October 2020 to December 2020. This questionnaire was validated by randomly selecting academicians from various dental colleges and private dental professionals. This questionnaire was then finalized with the statistician and unsuitable questions were modified based on their suggestions.

125 dentists participated in this survey. The questionnaire comprised of 29 questions (5 questions to collect the demographic data of the participants, 1 question regarding awareness about piezosurgery, 11 questions related to knowledge, 7 questions assessing the attitude of the participant, 4 questions related to the practice of piezosurgery and finally 1 question was given to elaborate the participant's opinion on piezosurgery).

The questionnaire was circulated digitally (google forms & emails) and responses were recorded.

2.2 Significance for Conducting the Study

To impart knowledge about piezosurgery and its advantages to the general dentist so as to benefit the public for better and comfortable surgical procedures.

2.3 Statistical Analysis

The responses were compiled using Microsoft XL sheets, and the data was statistically analysed using the XLSTAT 2014 software. The basic data was expressed using frequency with percentages and by diagrams. For expressing quantitative variable, mean and standard deviation were used. Kruskal wallis test was used to compare whether knowledge score differed by characteristics of the selected variables and Dunn's post hoc test was applied to find out which of the characteristics were statistically significant.

3. RESULTS AND DISCUSSION

A total of 125 subjects participated in this study. Demographic details of the respondents are summarized in Table 1.

Table 1. Distribution of the respondents by selected background variables

Variables	No. (N=125)	%
Gender		
Male	52	41.6
Female	73	58.4
Age in years		
25-30	55	44.0
30-40	40	32.0
40-50	26	20.8
>50	4	3.2
Qualifications		
BDS	26	20.8
MDS	79	63.2
Post graduate	20	16.0
Any other qualification		
Years of Practice		
<= 5 years	60	48.0
6-10 years	24	19.2
>10 years	41	32.8
Types of practice		
General dentist	41	32.8
Speciality practice	26	20.8
Institution	15	12.0
Private & Institution	43	34.4

3.1 Awareness

Out of the 125 participants in this study, 104 participants were aware about piezosurgery and 21 participants were totally unaware about its usage in the field of dentistry, and they were excluded from the study (Fig.1).

The dentists participating in this study updated their knowledge in the field of dentistry by various ways. 32% of the dentists attended multiple conferences which maybe either national or international, and 41% read journals pertaining to the recent trends in the field. 20% of the participants accepted that social media played a major role in updating themselves and 7% used other sources to renew their knowledge (Fig. 2).

3.2 Knowledge

Among the participants, 53.8% gave the correct response regarding the effective piezoelectric wavelength, 88.5% knew that different types of tips are available in piezotome. While questioned about the applications of piezo in various branches of dentistry, the following responses were given as shown in Table 2. Endodontics (73.1%), periodontics (86.5%), orthodontics (65.4%), Implant and oral surgical procedures (84.6%,76% respectively). 92.3 % of the participants had knowledge about various

advantages of using piezotome and 72.1% of them were aware about the disadvantages pertaining to its use. 60.6% know contraindications for performing piezosurgery.

3.3 Knowledge Score

The knowledge score was computed as shown in **figure.3**. 64% of the dentists had adequate knowledge about piezosurgery, 25% had moderately adequate and 12% of the dentists were considered to have inadequate knowledge about piezosurgery.

3.4 Attitude of Dentists Towards Piezosurgery

Among the participants, 75% of them agreed that piezotome can be more effectively used in bone surgery. >65% agreed that along with osteotome and chisel, piezotome can be used an adjunct for removing bone. 86.5% of the dentist agreed that piezo surgery is less traumatic when compared to traditional methods of bone harvesting. 76% of them felt there is a lack of awareness regarding piezo among dentist and surgeries using piezoelectric equipment should be taught in the institutional level for the upcoming dentist (Table 3).

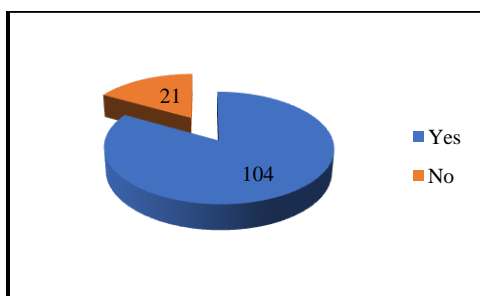


Fig. 1. Awareness about piezosurgery

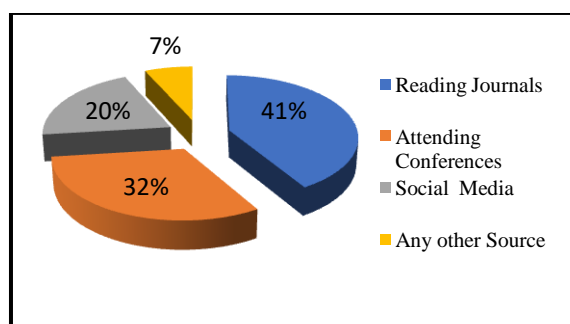


Fig. 2. Main Source of Knowledge Update

Table 2. Distribution of the respondents based on their response to the knowledge questions on piezoelectric procedure

Knowledge questions	Correct response No.(N=104)	%
Effective Piezoelectric wavelength	56	53.8
What are the different types of tips available in piezoelectric device	92	88.5
Advantages of piezoelectric includes	96	92.3
Piezoelectric surgery is contraindicated in?	63	60.6
Application of piezo in Endodontics includes	76	73.1
Application of piezo in Periodontics includes	90	86.5
Application of piezo in Implant related surgery includes	88	84.6
Application of piezo in oral surgery includes	79	76.0
Application of piezo in orthodontics includes	68	65.4
Disadvantages of piezo includes	75	72.1

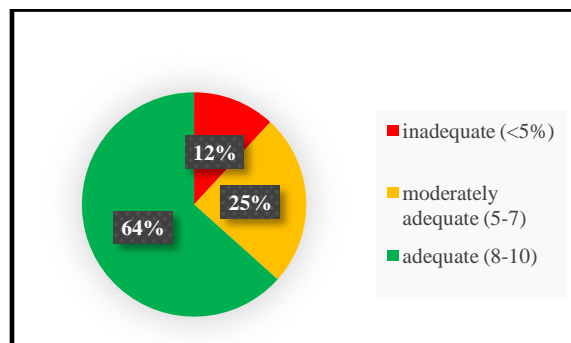


Fig. 3. Distribution of respondents based on their knowledge score on piezoelectric procedure

Table 3. Assessment of responses to attitude statements (%)

Statements	Disagree	Neutral	Agree
Piezo can be more effective in bone surgery	1.0	24.0	75.0
Piezo electric equipment can be used as an adjunct to osteotome bone removal	4.8	26.9	68.3
Piezo electric equipment can be used as an adjunct to Chisel in bone removal	8.7	21.2	70.1
Piezo Surgery is less traumatic when compared to traditional bone harvesting Techniques	--	13.5	86.5
Surgery using Piezoelectric equipment should be given adequate importance in dental education	1.0	14.4	86.6
There is lack of awareness regarding piezosurgery amongst dentists	--	24.0	76.0

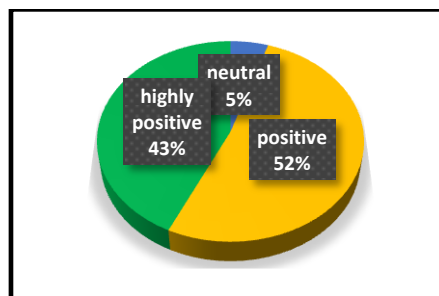


Fig. 4. Distribution of respondents based on their attitude status towards piezoelectric procedure

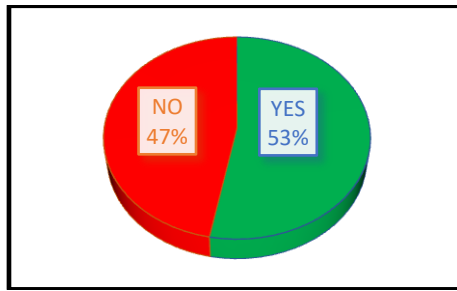


Fig. 5. Practice of piezosurgery

Table 4. Distribution of respondents based on their experience

Variables	No. (N=55)	%
Duration of use		
< 6 months	24	43.6
6-12 months	9	16.4
>12 months	22	40.0
Most Frequent techniques used		
Sinus lift procedure	9	16.4
Harvesting Bone	26	47.3
Ostectomy	12	21.8
Ridge split	8	14.5
Patient compliance is more while using piezo electric device		
Yes	45	81.8
No	10	18.2

3.5 Attitude Status

Among the dentists participating in this study, 43% showed highly positive attitude and 52% positive attitude towards piezoelectric procedure (Fig. 4).

3.6 Self-reported Practice of Piezosurgery

Almost 53% of the dentists participating in this study are using piezotome in their routine clinical practice and 47% do not use it in their dental practice (Fig.5).

3.7 Duration and Frequency

Piezotome was used to multiple purposes in dentistry. 47% dentists use piezotome for harvesting bone, 21% for ostectomy, 16% for sinus lift procedure, and 14.5% for splitting the ridge. 40% dentists have been using piezotome in their dental practice for more than a year (Table.4).

3.8 Patient Acceptance

More than 80% of dentists accepted that patient compliance is more while using piezotome (Table.4).

4. DISCUSSION

Piezoelectricity is the electric charge that accumulates in certain solid materials (crystals, ceramics) and biological matter (Bone, proteins) in response to applied mechanical stress. The word 'Piezo' originates from Greek word which is synonymous with squeeze, press or pressure [10]. The piezoelectric effect was first proven in 1880 by brothers Pierre, Jacques curie and it was Dr. Tomaso Vercelotti in 1988 [11] who applied this effect in surgery and patented the term "piezo surgery". He also invented the piezosurgery device (piezotome) which is akin to an ultrasound machine with a modulated functional frequency of 25- 30 kHz and a controlled tip vibration range.

Ultrasonic bone surgery or surgery using piezotome has been employed in the field of dentistry for more than 30 years. Piezotome is a specially designed tool with a modulated ultrasonic frequency of 25-30kHz with adjusted micro vibrations ranging from 60 to 200mm/sec targeting only mineralized tissues [9]. It has a high precision and safely cuts the hard tissues sparing soft tissues, nerves and vessels [12].

Various cutting tips or inserts are available: 1. Titanium nitrate coated tips for osteoplasty and harvesting bone chips 2. Diamond coating tips for osteotomy in thin bone or for complete osteotomy which are close to anatomical structures 3. Sharp insert tips for bone cutting 4. Smooth insert tips for preparing delicate structures 5. Blunt insert tips are for sinus membrane elevation, nerve lateralization and for root planning procedures [6].

In the past decades, bone cutting was customarily performed using motorized instruments. Excessive heat production, requiring irrigation from external source and pressure exerted by the increased vibrations from the burs were the inadvertent effects of using these motor driven devices [15].

Piezotome with its well-known precision and intra-operative safety, has overcome all the fore mentioned drawbacks. Ever since piezotome has proven to be evidence-based alternative to traditional surgical tools, it is very essential for the dentists to have a good knowledge to use piezotome more effectively and deliver a good care to the patients.

The present study was conducted to determine the knowledge, attitude, and practice of piezosurgery among dental professionals. A total of 125 dentists actively participated in this questionnaire study, 73 females and 52 males. Post graduates, MDS qualified dentists running a private dental setup and attached to institutions participated in large numbers with the years of dental practice ≤ 5 years.

Overall majority of the dentists participating in this study had awareness and good knowledge about piezosurgery, its applications in the field of dentistry, advantages, disadvantages which were assessed by the knowledge score. 10 questions were given to assess the knowledge about piezosurgery and more than 8-10 correct responses were given by 64% of the dentists. More than 95% of the participants showed a positive attitude towards piezo surgical procedures and expressed to update their knowledge in future.

Vercellotti et al. in 2005 [13] assessed the postoperative wound healing in a dog model after osteotomy and osteoplasty using piezotome and burs (carbide and diamond). The surgical sites treated with burs showed loss of bone whereas in there was gain in bone and regeneration of

cementum and periodontal ligament in the area of piezosurgery. They concluded that piezosurgery is favours bone repair and regarded more constructive and effectual in bone surgeries. In our study 75% of the dentists agreed that piezo can be used more effectively in bone surgeries and greater number of the dentists agreed it that piezotome can be used as an adjunct to osteotome (68%) and chisel (70.1%) for bone removal.

Arndt Happe in 2007 [14] used piezosurgical device in 45 donor sites to harvest bone grafts from the mandibular ramus region. Harvested grafts were placed in recipient sites with inadequate bone volume (maxilla and mandible) prior to implant placement. He concluded that the osteotomies using piezotome was very precise and less traumatic which allowed better visibility and in majority of the sites healing was satisfactory.

In our study, 47.3% of the dentists used piezosurgical device for harvesting bone, 21.8% for osteotomy, 14.5% for ridge split and 16.4% for sinus lift procedures. Greater than 85 % of dentists agreed that piezosurgery was less traumatic when compared to the other traditional methods.

Athira et al in 2020 [16] conducted a study in 100 dental practioners in chennai comprising of 16 questions and they concluded that the awareness regarding piezosurgery is less. But the study sample was confined to a particular locality and the limited number of questions was the drawbacks of their study.

To the best of our knowledge, very few studies have been done to assess the KAP about piezosurgery among dental professional in the state of Tamil Nadu (India).

4.1 Strengths and Limitations of the Study

The major strength of this study is the categorization of the questions in each section to identify and record the responses precisely given by the participants. The limitation of this study was the essentially small number of participants.

5. CONCLUSION

This study showed that majority of the dental professionals had good awareness, knowledge and attitude about piezosurgery and they

understand the advantage of using piezo over traditional methods. eventhough more than 50% of the dentists in this study practicing piezo in their routine dental practice, others may have practical difficulties. This could be probably because of the cost of the piezo device and the clinical expertise needed to perform surgeries using piezotome. These can overcome by attaining knowledge by attending conferences, live workshops and CDE programs. The inclusion of this innovative technology in dental curriculum and by proper training instituted by experienced and skilled practitioners, Piezosurgery can spread its wings further more in the field of dentistry.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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