

KNOWLEDGE, AWARENESS AND PRACTICE REGARDING PIEZOELECTRIC SURGERY AMONG DENTAL STUDENTS

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Article Info

Volume 82

Page Number: 17196 - 17203

Publication Issue:

January - February 2020

Article History

Article Received: 18 October 2019

Revised: 14 November 2019

Accepted: 22 December 2019

Publication: 29 February 2020

Abstract

Piezoelectric surgery is a minimally invasive technique that lessens the risk of damage to surrounding soft tissues and important structures such as nerves, vessels, and mucosa. The main aim of the present study is to assess the knowledge, awareness and practice of dental students based on the usage of piezoelectric surgery. The objective of the study was to perform a knowledge, awareness and practice of dental students based on the choice and the technique of piezoelectric surgery. Sample size of 100 dental practitioners who perform surgical procedures were considered as participants. A questionnaire comprising of 10 questions on the incidence, technique and major aspects of piezoelectric surgery was given. The subjects were made to fill the questionnaire through an online portal. The recordings were made individually by the investigator and results were analyzed. All the data was arranged in a tabulated form and analysed using SPSS software. The results inferred from the study show that 68% of the participants were aware of the term piezoelectric surgery, 75% believe it was originally developed for the atraumatic cutting of bone, most of them were ware of the advantages and uses of piezoelectric surgery, 52% were aware of Er:YAG laser is used in this technique. From the study we can conclude that there is sufficient knowledge amongst the dental practitioners regarding choice and the technique of piezoelectric surgery.

Key words: piezoelectric, technique, awareness, difficulty

INTRODUCTION

Piezoelectric surgery may be a minimally invasive technique that lessens the danger of injury to surrounding soft tissues and

important structures like nerves, vessels, and mucosa. It also reduces damage to osteocytes and permits good survival of bony cells during harvesting of bone (Labanca et al.,

2008). Piezoelectric surgery was first used by oral and maxillofacial surgeons for osteotomies, but recently it is employed for specific applications in neurosurgery and orthopaedics as well (Vercellotti, 2000)

In 1880, piezoelectricity was discovered by Jacques and Curie . In 1953, in the field of dentistry, ultrasonics established itself mainly in periodontology and endodontics when Catuna first reported the cutting effects of high frequency sound waves on the dental hard tissue . (Rahnama et al., 2013)

Piezoelectric devices usually consist of handpiece and foot switch that are connected to the main power unit. This has a holder for the handpiece and contains irrigation fluids that create an adjustable jet pump removing debris from the cutting area and maintains a blood free operating area because of cavitation of the irrigation solution giving greater visibility particularly in complex anatomical areas by dispersing coolant fluid as an aerosol (Wallace et al., 2007). The piezoelectric system is based on the fact that certain crystalline structures such as quartz will be subject to a change in shape when placed within an electric field .

Piezoelectric equipment can be used for endodontic surgery, periodontology and implantology, scaling subgingival plaque, osteotomy and osteoplasty procedures to create positive physiologic architecture of bone support of the involved teeth, harvesting bone blocks and bone grafting, sinus lift procedure, ridge augmentation, and ridge expansion, tooth extraction, cystectomy, maxillofacial surgery, surgical orthodontic surgery, otological surgery, neurosurgery, orthopedic, and hand surgery (Horton et al.,

1975). The advantages of the piezosurgery for augmentative purposes, sinus floor elevation carries a way lower risk of perforation or injury to the mucous membrane since soft tissues cannot be damaged with this method (Konuganti et al., 2009).

The most convincing characteristics of piezoelectric bone surgery are low surgical trauma, exceptional control during surgery, and a quick healing response of tissues (Seshan et al., 2009). Clinical studies have demonstrated the specificity and hence the technique employed with piezoelectric surgery makes it possible to advantageously exploit differences in hard and soft tissue anatomy. This not only increases treatment efficacy but it also improves postoperative recovery and healing (Aro et al., 1981).The objective of the study was to perform a knowledge, awareness and practice of dental students based on the choice and the technique of piezoelectric surgery.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted among 100 dental students at Saveetha Dental College and Hospitals, Chennai. The study instrument was a structured, self administrable questionnaire consisting of 10 close ended questions through an online survey, encompassing major aspects of piezoelectric surgery prepared to know the awareness on incidence and usage of piezoelectric surgery in dental practice. The answers were tabulated and statistical analysis was performed using SPSS software.

QUESTIONNAIRE:

1) Are you aware of the term piezoelectric surgery?

A. Yes

B. No

2) Piezosurgery device was originally developed for the atraumatic cutting of bone by way of ultrasonic vibrations?

A. Yes

B. No

3) Advantages of piezoelectric technique include?

A. Precise and selective cuttings

B. Avoidance of thermal damage

C. Preservation of soft-tissue structures

D. All of the above

4) Approaches are more efficient in reducing postoperative complications compared to the conventional surgeries.

A. Agree

B. Disagree

5) Piezo surgery is used for the following treatments?

A. Harvesting bone blocks and bone grafting

B. Bone osteotomy or corticotomy

C. Tooth extraction

D. Sinus lift procedure

E. Cystectomy

F. All of the above

6) Lasers which are commonly used in piezoelectric surgery?

A. Er:YAG (2940 nm)

B. Er,Cr:YSGG (2780 nm)

7) Application of mechanical stress on the piezoelectric material leads to generation of electricity. This is known as?

A. Direct piezo effect

B. Inverse piezo effect

8) Application of electricity on the piezoelectric material leads to physical deformation and thus causes generation of mechanical force. This is known as?

A. Direct piezo effect

B. Inverse piezo effect

9) Insert tips of Gold colour are used to treat

A. Bone

B. Soft tissues

10) Insert tips of stainless steel are used to treat

A. Bone

B. Soft tissues

RESULTS

The results of the study are depicted below.
[Fig1-10]

Figure 1: Are you aware of the term piezoelectric surgery?

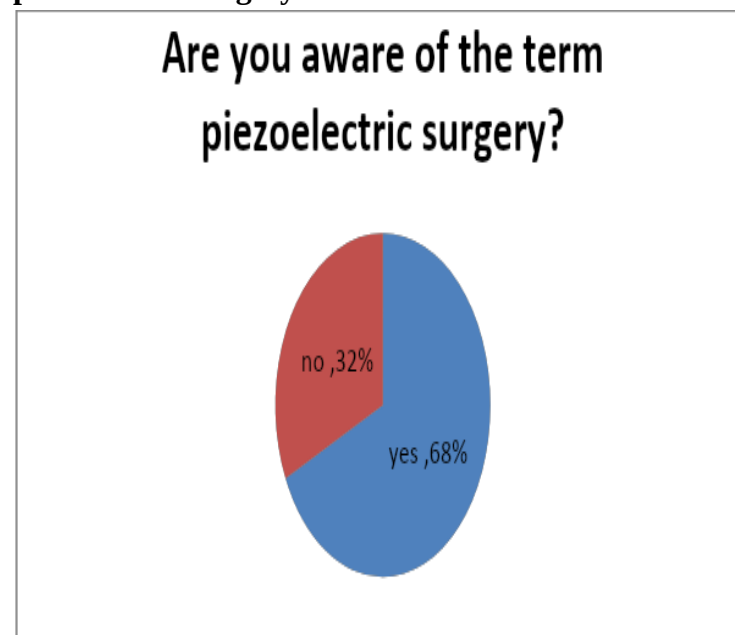


Figure 2: Piezosurgery device was originally developed for the atraumatic cutting of bone by way of ultrasonic vibrations?

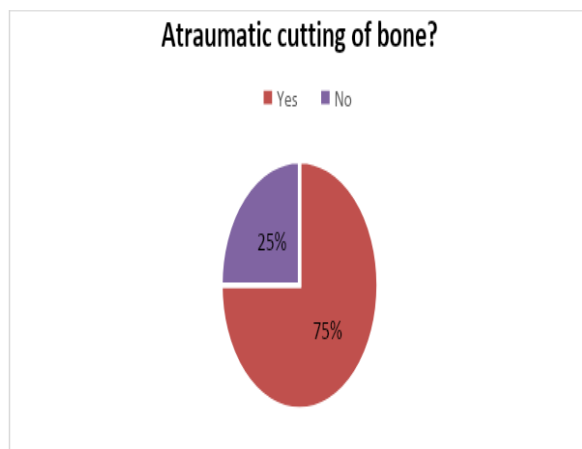


Figure 3: Advantages of piezoelectric technique include?

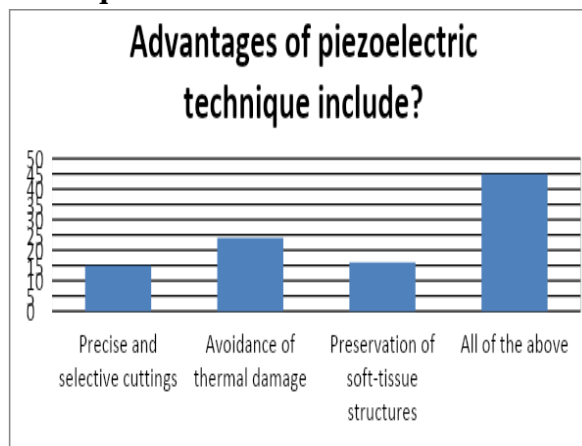


Figure 4: Approaches are more efficient in reducing postoperative complications compared to the conventional surgeries.

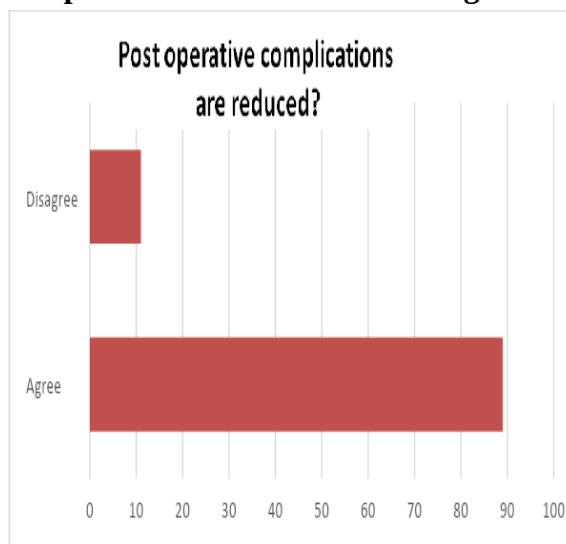


Figure 5: Piezo surgery is used for the following treatments?

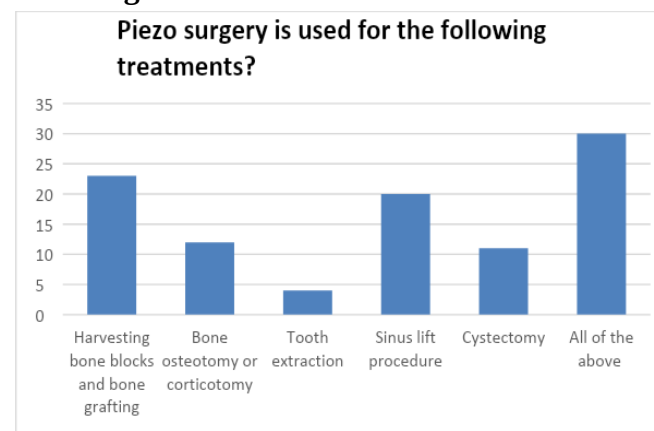


Figure 6: Lasers which are commonly used in peizoelectric surgery?

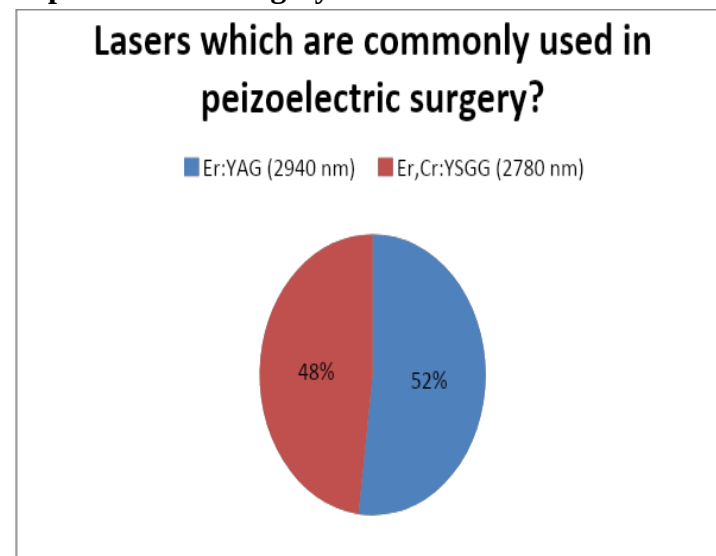


Figure 7: Application of mechanical stress on the piezoelectric material leads to generation of electricity. This is known as?

Application of mechanical stress on the piezoelectric material leads to generation of electricity. This is known as?

■ Direct piezo effect ■ Indirect piezo effect

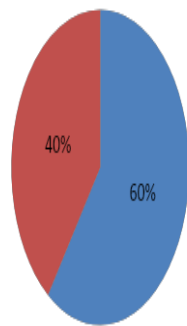


Figure 8: Application of electricity on the piezoelectric material leads to physical deformation and thus causes generation of mechanical force. This is known as?

Application of electricity on the piezoelectric material leads to physical deformation and thus causes generation of mechanical force. This is known as?

■ Direct piezo effect ■ Indirect piezo effect

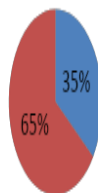


Figure 9: Insert tips of Gold colour are used to treat?

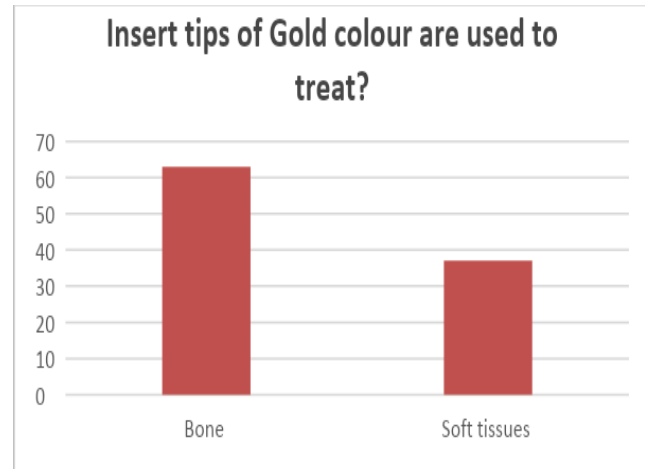
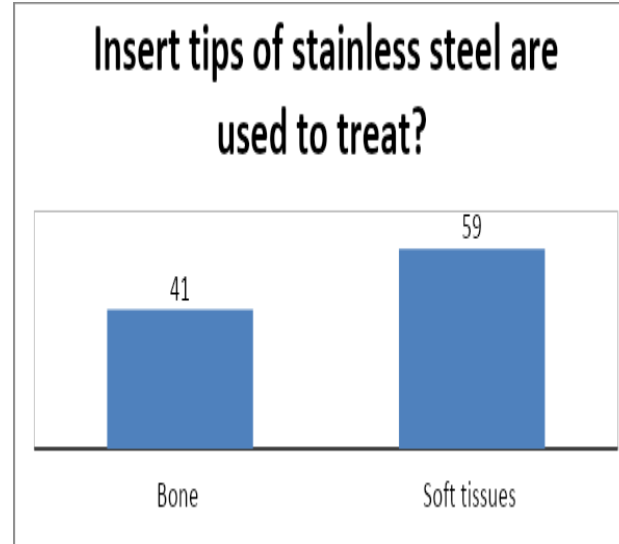


Figure 10: Insert tips of stainless steel are used to treat?



RESULTS AND DISCUSSION

Based on the above results, 68% of the participants were aware of the term piezoelectric surgery which is gaining popularity in the field of dentistry in the recent years. Regarding about the atraumatic cutting of bone, 75% of the population was aware of it. In a study conducted by Wallace et al, it was suggested for the utilization of

piezoelectric surgery, rather than rotary diamond burs, for lateral window preparation and hence reduction in intraoperative complications (Wallace et al., 2012).

Advantages of piezoelectric surgery include avoidance of thermal damage, precise and selective cutting, and preservation of soft tissue structures and were opted by 45% of the participants which is in accordance with a study done by Ealla et al in 2017 (Ealla et al., 2017).

In this study 89% of the population believed that post operative complications are reduced by the usage of this technique. In a study done by Shirota et al, the effectiveness of piezoelectric surgery in reducing surgical complications after bilateral sagittal split osteotomy was shown (Shirota et al., 2014).

Piezo surgery is used for the following treatments- Harvesting bone blocks and bone grafting, Bone osteotomy or corticotomy, Tooth extraction, Sinus lift procedure, Cystectomy which 30% of the population selected for all of the above treatments. The use of Piezoelectric osteotomy in craniofacial surgery was suggested in a study done by Gleizal et al (Gleizal et al., 2007).

Lasers which are commonly used in piezoelectric surgery is Er:YAG (2940 nm) opted by 52% followed by Er,Cr:YSGG (2780 nm) opted by 48%. The use of Er:YAG laser for impacted third molar surgery was shown in a study done by Keyhan SO et al in december 2019 (Keyhan et al., 2019, 2020). Application of mechanical stress on the piezoelectric material leads to generation of electricity and this is known as direct piezo effect, opted by 60% of the participants. Application of electricity on the piezoelectric

material leads to physical deformation and thus causes generation of mechanical force and this is known as indirect piezo effect (65%). Relationship between direct and converse piezoelectric effect in a nanoscale electromechanical contact was reviewed by Kalinin et al . (Kalinin et al., 2007)

Insert tips of gold are used to treat bone (63%). Insert tips of stainless steel are used to treat soft tissues (59%). Most of the periodontal and oral surgical procedures require bone cutting. Although traditional method of bone surgery provides better predictability and ease of application, they have several drawbacks such as a high heat generation, damage to the cells, necrosis of the tissues. To overcome these factors the piezoelectric surgery has been introduced which causes micro metric and selective cutting, creates a clear cutting field and excellent tissue healing .

As a result, periodontal and implant surgical techniques can be performed with greater ease and safety. The better clinical results are due to its positive effects on the first phases of bony healing; it induces an earlier increase in bone morphogenetic proteins, controls the inflammatory process (Vignesh & Thamariselvan, 2016). With the advancement in the field of dentistry, implant-supported prosthesis is no more a big challenge and hence piezoelectric surgery has paved the way for direct sinus lift with immediate implant placement Maxillary sinus lift with an accompanying bone graft serves as a simple, widely used procedure (Vidhya & Nesappan, 2016).

CONCLUSION

As per the data, though the knowledge, awareness and practice among the dental practitioners regarding the piezoelectric surgery is adequate, there is a need for an update regarding the correct and current application of these critically important aspects in dentistry for providing better treatment without any complications.

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