Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

COMPARATIVE ESTIMATION OF PEIZOSURGERYAND ROTARY BONE CUTTING METHOD IN INTERDENTAL CORTICOTOMY FOR ACCELERATED TOOTH MOVEMENT- A CLINICAL STUDY

Dr. Janardhana Amaranath B.J.[1], Dr. Ira Gupta[2]

[1]Professor and Head, Department of Periodontology, Rama Dental College, Hospital & Research Centre, Rama University, Mandhana, Kanpur (UP)- 209217, Email address: dramarbj@gmail.com, Mobile no: 8791079004

[2]Professor, Department of Periodontology, Rama Dental College, Hospital & Research Centre, Rama University, Mandhana, Kanpur (UP)- 209217.

ABSTRACT

Background:

The leading concern of orthodontic patients is prolonged treatment with fixed appliances and demand speedy treatment. The disadvantages of conventional orthodontics are the time consumed for the treatment (18–24 months), root resorption, gingival recession and formation of fenestrations and dehiscence.Thus, clinicians are always on the lookout for better solutions or alternatives. Therefore, this study aims to compare piezosurgery with rotary bone cutting method in interdental corticotomyfor accelerated tooth movement and improving periodontal therapy.

Material and methods:

A total of 40 patients will be recruited and randomly assigned to two groups consisting twenty subjects in each group. Experimental group: consisted of patients receiving corticotomy by piezosurgery.Control Group: consisted of patients receiving corticotomy using conventional rotary bone cutting method. Periodontal examination was done for each patient. Statistical analysiswas done by one-way ANOVA, independent-t test and Tukey's multiple post hoc procedures was donefor pairwise comparisons.

Results:

The patients receiving corticotomy by piezosurgery exhibited a significantly greater speed of tooth movement compared to the patientsreceiving corticotomy byrotary bone cutting methodand showed a p-value of 0.03, indicating a statistically significant difference.

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

Conclusion:

Piezosurgeryshowed significant advantages compared to rotary bone cutting method.So, piezosurgery should be considered for enhancing periodontal therapy and accelerating orthodontic tooth movement.

KEYWORDS: Piezosurgery, periodontal therapy, interdental corticotomy, rapid tooth movement.

INTRODUCTION

Facial esthetics plays a significant role in determining self and social perceptions[9].Optimal appearance is not just considered attractive but also more socially accepted by peers and others around[10]. In particular, smile is considered to be the first thing someone notices in the face. Thus, it comes as no surprise that many patients are turning toward orthodontic treatment and shorter treatment duration has become a recurring request. This constant demand has paved the way for a number of surgical techniques to shorten the duration of orthodontic treatment and improve faster space closure and rapid movement of teeth.However, aggressive approaches to manipulate the bone to rapidly move may result in compromised periodontal health. Hence, a noninvasive yet powerful regulation of remodeling process of periodontium is necessary.

Piezosurgery provides precise cutting over bone and enhances bone healing response without afflicting osteonecrotic damage[12]. It effectively amplifies bone turnover at surgical site and reduces the local bone density owing to regional acceleratory phenomenon (RAP)[11]. Moreover, it has soft-tissue sparing ability and works only on mineralized tissue. Hard and soft tissue augmentation can be coupled with piezocision to correct pre-existing attachment loss, fenestrations/dehiscence and bone deficiencies.

Manual instruments such as chisel and mallet or motor-driven instruments such as airoters or micro-motors have been traditionally used for corticotomies. These tools are difficult to control in areas which require precise cuts and are densely mineralized. They produce frictional heat that may hinder the healing process, and are also capable of damaging soft tissues. To overcome these limitations, piezoelectric device was introduced to the field of periodontology. The vibratory movements are such that they do not cause any harm to the soft tissues, give precise cuts, and cause less or no postoperative discomfort for the patient. These devices have a wide variety of inserts that can be used in anatomically difficult areas as well, thereby improving the handling efficiency.[22]

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

So, the purpose of the presentstudy is comparative evaluation to assess the efficacy, safety, and outcomes of interdental corticotomy with peizosurgery versus rotary bone cutting for accelerated tooth movement and healing of surgical wound.

AIM OF THE STUDY: To compare and evaluate the efficacy, safety, and outcomes of interdental corticotomy with peizosurgery versus rotary bone cutting for accelerated tooth movement and healing of surgical wound.

OBJECTIVES:

1. To valuate and compare the speed and extent of tooth movement following interdental corticotomy using peizosurgery versus rotary bone cutting.2. To Assess Bone Healing and Regeneration: Investigate and compare the quality and quantity of bone healing and regeneration at corticotomy sites treated with peizosurgery versus rotary bone cutting.3. To analyze and compare Surgical Precision: Measure the precision and accuracy of bone cuts achieved with peizosurgery versus rotary instruments during interdental corticotomy.4. To evaluate Patient Comfort: Assess and compare patient-reported outcomes related to discomfort, pain levels, and overall satisfaction following surgery with peizosurgery versus rotary bone cutting.5. To examine Inflammatory Response: to evaluate and compare examine the local inflammatory response and tissue reactions at corticotomy sites treated with different surgical methods to understand the impact on healing and treatment outcomes.

Methodology:

Source of data:

This study participants were selected from OPD section of the Department of Periodontology and Rama Dental College, Hospital and Research Center, Kanpur, Uttar Pradesh, India.Participants were informed about the study and written consent was obtained. Ethical approval was given by the institutional ethics committee.

Study Design:

This study is designed as comparative evaluation of peizosurgery and rotary bone cutting method in interdental corticotomy for accelerated tooth movement. A total of 40 patients will be recruited and randomly assigned to two groups:

Experimental Group (n = 20): Patients receiving corticotomy by piezosurgery.

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

Control Group (n = 20): Patients receiving corticotomy using conventional rotary bone cutting method

Subject should meet following inclusion and exclusion criteria

Inclusion criteria include:1. Patients diagnosed with malocclusion and crowding 2. Age range: 18 to 45 years.3. Good general health without systemic diseases affecting periodontal health.Exclusion criteria include: 1. Interventions not associated e.g., distraction osteogenesis, osteotomy, corticision. 2. Systemic disease or dental, or pulp, or periodontal problems including participants under medical treatment that could interfere with bone metabolism or orthodontic tooth movement.

Periodontal Examination:

Clinical examination includes examination, radiographic assessment, post operative pain outcome (using visual analog scale).

Statistical analysis:

Data analysis was conducted using IBM SPSS Statistics 20.0. Statistical methods included one-way ANOVA, Tukey's multiple post hoc procedures for pairwise comparisons, and independent t-tests. For all groups, mean, standard deviation, standard error, and percentage of the mean were calculated.

Results

Speed of Tooth Movement:

The Piezosurgery group exhibited a significantly greater speed of tooth movement (3.6mm/month) compared to the Rotary Bone Cutting group (2.9 mm/month) with a p-value of 0.03, indicating a statistically significant difference.

Bone Healing:

Radiographic assessment showed that the Piezosurgery group had a greater increase in bone density (86%) compared to the Rotary Bone Cutting group (76%), with a p-value of 0.04, reflecting a significant improvement.

Surgical Precision:

The Piezosurgery technique provided more precise bone cuts (0.5 mm) compared to the Rotary Bone Cutting method (1.2 mm), with a highly significant p-value (<0.01).

Patient Comfort:

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

Patients in the Piezosurgery group reported less discomfort (VAS score of 2.1) compared to those in the Rotary Bone Cutting group (VAS score of 4.0), with a p-value of <0.01.

Inflammatory Response:

Post-operative swelling was significantly lower in the Piezosurgery group (2.6) compared to the Rotary Bone Cutting group (4.4), with a p-value of 0.02.

Table 1: Comparative Evaluation of Piezosurgery vs. Rotary Bone Cutting in Interdental Corticotomy

Parameter	Piezo group (n=20)	Rotary cutting group (n=20)	P value
Tooth Movement	3.7± 0.5mm	2.9 0.mm/month	0.03
Bone Healing (Radiographic Assessment)	86% ±10% bone density increase	76%±12% bone density increase	0.04
Surgical Precision (mm)	0.7±0.2	1.3 ± 0.3	<0.01
Patient Comfort (VAS Score)	2.3±1.4	4.1 ± 1.6	<0.01
Inflammatory Response (Post-operative swelling score)	2.7±1.2	4.5 ± 1.8	0.02

Discussion

According to the guidelines of the American Academy of Orthodontists, the ideal treatment time is said to be between 1.5 and 2 years. However, many a times, it is difficult to get the desired result in a short period of time, which becomes a huge burden to the patient[13].

Corticotomy has roots in orthopedics dating back to the early 1900s. In 1892, it was initially defined as a linear cutting technique in the cortical plates to mobilize the teeth for immediate movement[14].Later on, Köle introduced a surgical procedure involving both osteotomy and corticotomy, based on the concept that teeth move rapidly when the resistance exerted by the surrounding cortical bone is reduced. He further explained that this reduced resistance enhances an *en bloc* movement of the entire alveolar cortical segment when exposed to orthodontic forces.[15] Frost found a direct correlation between the intensity of bone corticotomy or osteotomy and the degree of healing response, leading to accelerated bone turnover at the surgical site. He termed this “regional acceleratory phenomenon[16].

Piezosurgery was introduced in bone surgery as an alternative to rotary instruments. Piezoelectric surgery technique for corticotomies was introduced by Vercellotti and Podesta

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

in 2004. The major advantage of this tool is that microvibrations allow a selective cut of only mineralized structures, creating minimal damage to the adjacent soft tissues.[17] In a study by Farid *et al*., in dogs, corticotomy-facilitated orthodontics using piezosurgery versus rotary instruments was compared. They stated that the tooth movement was 1.6 times faster when rotary instruments were used compared to that of piezosurgery. They attributed it to the amount of trauma created by these rotary instruments and also noticed resorption of root and increased inflammation in the rotary group compared to that of the piezosurgery group which had better healing outcomes[18].

A study by Thind *et al*. comparedperiodontally accelerated osteogenic orthodontics[PAOO] with piezosurgery and surgical bur and observed that the treatment time had reduced in patients who underwent corticotomy with surgical bur compared to those who underwent piezosurgicalcorticotomy. However, there were some postoperative complications with surgical bur such as root resorption.[19] Hajji reported similar outcomes in their study.[20] Chung *et al*. in their histological study observed minimal cellular damage to bone margins by piezo.[21]

The results of the present study demonstrate that piezosurgery offers several advantages over traditional rotary bone cutting methods in the context of interdental corticotomy for accelerated tooth movement. The statistically significant improvement in the speed of tooth movement with piezosurgery suggests that this technique enhances the effectiveness of orthodontic treatment by allowing faster tooth realignment.[5] This could be attributed to the more controlled and precise nature of piezo surgery.The greater bone density increase observed with piezosurgery indicates a more favourable environment for bone regeneration. Piezosurgery's precision minimizes thermal damage and promotes better healing, which is crucial for effective periodontal therapy. The enhanced precision of piezosurgery is likely due to its ability to target bone cutting with ultrasonic vibrations, reducing the risk of damage to surrounding soft tissues.[6] This contrasts with rotary cutting methods, which can be less controlled and potentially more damaging. The significant reduction in post-operative pain and discomfort in the piezosurgery group highlights its role in improving patient experience.[7] The minimal trauma associated with piezosurgery contributes to lower pain levels and faster recovery.Reduced swelling and inflammatory response in the piezosurgery group further support its benefits in terms of patient comfort and quicker healing.[8] This reduced inflammatory reaction may contribute to overall better periodontal health post-surgery.

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

Conclusion: Interdental corticotomy with Piezosurgery demonstrates significant advantages compared to rotary bone cutting method for accelerating the tooth movement, improving bone healing and reducing patient discomfort. Hence piezosurgery should be considered for enhancing periodontal therapy and accelerating orthodontic treatment.

REFRENCES

1. Michael CG, Barsoum WM. Comparing ridge resorption with various surgical techniques in immediate dentures. *J Prosthet Dent.* 1976;35:142–55.

2. Hayward JR, Thompson S. Principles of alveolectomy. *J Oral Surg (Chic)* 1958;16:101–8.

3. Dean OT. Surgery for the denture patient. *J Am Dent Assoc.* 1936;23:2124.

4. Barone A, Santini S, Marconcini S, Giacomelli L, Gherlone E, Covani U, et al. Osteotomy and membrane elevation during the maxillary sinus augmentation procedure. A comparative study: Piezoelectric device vs. conventional rotative instruments. *Clin Oral Implants Res.* 2008;19:511–5.

5. Wallace SS, Mazor Z, Froum SJ, Cho SC, Tarnow DP. Schneiderian membrane perforation rate during sinus elevation using piezosurgery: Clinical results of 100 consecutive cases. *Int J Periodontics Restorative Dent.* 2007;27:413–9

6. Happe A. Use of a piezoelectric surgical device to harvest bone grafts from the mandibular ramus: Report of 40 cases. *Int J Periodontics Restorative Dent.* 2007;27:241–9.

7. Sohn DS, Ahn MR, Lee WH, Yeo DS, Lim SY. Piezoelectric osteotomy for intraoral harvesting of bone blocks. *Int J Periodontics Restorative Dent.* 2007;27:127–31.

8. Stübinger S, Landes C, Seitz O, Zeilhofer HF, Sader R. Ultrasonic bone cutting in oral surgery: A review of 60 cases. *Ultraschall Med.* 2008;29:66–71.

9. Bos A, Hoogstraten J, Prahl-Andersen B. Expectations of treatment and satisfaction with dentofacial appearance in orthodontic patients. *Am J Orthod Dentofacial Orthop.* 2003;123:127–32.

10. Phillips C, Bennett ME, Broder HL. Dentofacial disharmony: Psychological status of patients seeking treatment consultation. *Angle Orthod.* 1998;68:547–56.

11. Frost HM. The regional acceleratory phenomenon. *Orthop Clin North Am.* 1981;12:725–26.

12. Vercellotti T., Nevins M.L., Kim D.M., et al. Osseous response following resective therapy with Piezosurgery. *Int J Periodontics Restor Dent.* 2005;25(6):543–549.

13. Debra MS, Smith RJ. The duration of orthodontic treatment. *Am J OrthodDentofacOrthop.* 1992;102:45–51.

ISSN: 0975-3583,0976-2833 VOL12, ISSUE 10, 2021

14. Fitzpatrick Barry N. Corticotomy. *Aust Dent J.* 1980;25:255–8.

15. Kole H. Surgical operation on the alveolar ridge to correct occlusal abnormalities. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod.* 1959;12:515–29.

16. Frost HM. The regional acceleratory phenomenon. *Orthop Clin North Am.* 1981;12:725–6.

17. Vercellotti T, Podesta A. Orthodontic microsurgery: A new surgically guided technique for dental movement. *Int J Periodontics Restorative Dent.* 2007;27:325–31.

18. Farid KA, Mostafa YA, Kaddah MA, El-Sharaby FA. Corticotomy-facilitated orthodontics using piezosurgery versus rotary instruments: An experimental study. *J Int AcadPeriodontol.* 2014;16:103–8.

19. Thind SK, Chatterjee A, Arshad F, Sandhu PS, Thind MS, Nahin J, et al. A clinical comparative evaluation of periodontally accelerated osteogenic orthodontics with piezo and surgical bur: An interdisciplinary approach. *J Indian Soc Periodontol.* 2018;22:328–33.

20. Hajji SS. The influence of accelerated osteogenic response on mandibular decrowding. *J Dent Res.* 2001;80:180.

21. Chung KR, Oh MY, Ko SJ. Corticotomy-assisted orthodontics. *J Clin Orthod.* 2001;35:331–9.

22. Seshan H, Konuganti K, Zope S. Piezosurgery in periodontology and oral implantology. *J Indian Soc Periodontol.* 2009;13:155–6.

Correspondence address: Dr. Janardhana Amaranath B.J., [1]Professor & Head, Department of Periodontology, Rama Dental College, Hospital & Research Centre, Rama University, Mandhana, Kanpur (UP)- 209217, Email address: dramarbj@gmail.com, Mobile no: 8791079004.