Comparative evaluation of piezotome versus periotome extractions of non-restorable endodontically treated teeth: A randomized clinical trial

Lydia Melek
Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Egypt,
Lydia.nabil@dent.alex.edu.eg

Marwa G. Noureldin

Follow this and additional works at: https://digitalcommons.aaru.edu.jo/fdj

Part of the Dentistry Commons

Recommended Citation

This Article is brought to you for free and open access by Arab Journals Platform. It has been accepted for inclusion in Future Dental Journal of Egypt by an authorized editor. The journal is hosted on Digital Commons, an Elsevier platform. For more information, please contact rakan@aaru.edu.jo, marah@aaru.edu.jo, dr_ahmad@aaru.edu.jo.
Comparative evaluation of piezotome versus periotome extractions of non-restorable endodontically treated teeth: A randomized clinical trial

Lydia N. Melek*, Marwa G. Noureldin

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Egypt

ARTICLE INFO

Keywords:
Piezotome
Periotome
Non-restorable teeth
Atraumatic extractions
Bone loss

ABSTRACT

Aim: The study was intended to evaluate the efficacy of piezotome versus periotome extractions of non-restorable endodontically treated teeth in relation to prevention of marginal bone loss, operating time of the procedure, and postoperative sequelae.

Methods: Forty-two patients with age range of 30–55 years requiring extraction of maxillary single rooted teeth that failed endodontically were randomly divided into two equal groups, a piezotome group and a periotome group. Clinical assessment was performed through measuring the marginal bone loss, time taken for extraction, postoperative pain and any complications related to the extraction procedure. The data was recorded then analyzed using IBM SPSS software package version 22.0.

Results: The difference between the times required for extraction in both groups was not statistically significant, although slightly longer time was recorded in the piezotome group. The piezotome group showed a statistically significant lower value regarding the marginal bone loss when compared to the periotome group. On the other hand, concerning the severity of postoperative pain, both groups did not show a statistically significant difference.

Conclusions: The results of the present study suggest that the piezotome was a more efficient choice for preservation of marginal bone in endodontically failed teeth indicated for extractions compared to the periotome.

1. Introduction

Dental extraction is among the most frequently carried out procedures in dentistry. It was the first dental practice performed centuries ago. Since then different forms and designs of instruments have been popular for this procedure [1]. However, dental extraction is a traumatic method causing alveolar bone damage and soft tissue injury [2].

This unfortunate situation was the trigger for the development of atraumatic tooth extraction techniques, which aim for the removal of tooth or tooth root, while maintaining the gingiva, bone and the surrounding hard and soft tissue structures in a harmonious relation. Instruments such as periotome, piezotomies, Benex vertical extractor and physics forceps and many other have been specially designed to extract teeth atraumatically with minimum discomfort to patient [3].

Given the increased demand on implantology, atraumatic extraction has come to be an essential step and the use of periotomes has proved that it reduces soft tissue injury in addition to saving the bony integrity of the socket [4].

Moreover, when talking about atraumatic tooth extraction with preserving the surrounding integrity of soft tissue, the “Piezosurgery” comes to mind. It effectively enables the surgeon to work on bone and dentin [5].

To investigate atraumatic extraction, the study was intended to evaluate the efficacy of piezotome versus periotome extractions of non-restorable endodontically treated teeth in relation to prevention of marginal bone loss, operating time of the procedure, and postoperative sequelae.

2. Materials and methods

Forty-two patients (30 females and 12 males) with age range of 30–55 years were included in this prospective study who reported to Department of Oral and Maxillofacial surgery, Faculty of Dentistry, Alexandria University, requiring extraction of maxillary single rooted teeth that failed endodontically and consenting for the study. Ethical approval was obtained from the research ethics committee, Faculty of Dentistry, Alexandria University. Total 42 extractions (twelve centrals, six laterals, six canines, 18 s premolars) were done. The patients were
For the piezotome group, SATLEC ACTEON piezotome (A company of ACTEON Group, France) was used. LC1 and LC2 tips were used and secured to the hand piece. The LC1 tip was used for the labial/buccal and palatal surfaces of the root while the LC2 tip was used for the mesial and distal surfaces (Fig. 2). The vibrating osteotomy blade tips were inserted beneath the gingival margin between the bone and the root surface. Also, maintaining the parallelity to the long axis of the tooth, the blade was moved in a sweeping fashion; proceeding in small increments of 2-4 mm towards the apex. (Fig. 4B).

For both groups, cutting of the periodontal ligament was repeated on all of the four surfaces of the root (labial/buccal, palatal, mesial and distal). This action was performed till the root was completely mobilized then the final removal of the tooth was aided with the tooth specific forces.

A stop watch was used to measure the time taken for extraction in minutes and seconds (mins, secs). Recording time started from the application of the tip of the periotome or piezotome on the tooth till removal of tooth out of the socket. After that, clinical examination of the extracted tooth to inspect the root for fracture was performed.

The distance from the gingival margin to the marginal bone was measured and referred to as Post Extraction Bone level (Pob). It was measured by placing the probe at the edges of the socket at the previously chosen points.

Peb and Pob mean values of the three points were obtained and the amount of marginal bone loss was indicated by the difference between these two mean values.

All post extraction sites were covered by gauze pressure packs and the patients were given post-operative instructions. All the patients were prescribed Diclofenac Sodium Tab. 50 mg for 2 days.

Through follow up, postoperative pain was evaluated using the VAS scale on 1st and 3rd postoperative days and any other complications were also recorded.

Statistical significance was set at p = 0.05 and the data obtained from clinical findings was analyzed using Statistical Package for Social Sciences SPSS version 22.0.

3. Results

The present study was conducted on forty-two (30 female and 12 male) patients requiring extraction of single rooted teeth that failed endodontically, selected from the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University. Their ages ranged between 30 and 55 years with mean age of 37.67 years.

All the teeth extracted in this study were single rooted maxillary teeth with failed root canal treatment. The patients were randomly divided into two equal groups; a piezotome group and a periotome group each consisting of 21 patients. All patients were followed up...
Fig. 4. (A) periapical radiograph showing endodontically treated tooth indicated for extraction (B) Extraction using piezotome.

Table 1
Group Statistics for marginal bone loss.

<table>
<thead>
<tr>
<th>technique</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal bone loss</td>
<td>periotome</td>
<td>21</td>
<td>0.8333</td>
<td>0.5270</td>
</tr>
<tr>
<td></td>
<td>piezotome</td>
<td>21</td>
<td>0.5476</td>
<td>0.2182</td>
</tr>
</tbody>
</table>

Marginal bone loss

Table 2
Independent Samples Test for comparing the 2 groups regarding marginal bone loss.

<table>
<thead>
<tr>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>Marginal bone loss</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Fig. 5. Mean marginal bone loss in both groups.

Table 3
Group Statistics for time taken during extraction.

<table>
<thead>
<tr>
<th>technique</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timetaken for extraction</td>
<td>periotome</td>
<td>21</td>
<td>0:07:44</td>
<td>0:01:58</td>
</tr>
<tr>
<td></td>
<td>piezotome</td>
<td>21</td>
<td>0:08:45</td>
<td>0:01:59</td>
</tr>
</tbody>
</table>

Three.1. Marginal bone loss

Statistical analysis was performed using the independent samples t-test. The mean marginal bone loss in the periotome group was 0.833 mm (± 0.24 mm), while the mean marginal bone loss in the piezotome group was 0.54 mm (± 0.22 mm). The difference was statistically significant between the two groups (p < 0.05) [Table 1 and 2, Fig. 5].

Three.2. Time taken for extraction

Statistical analysis was performed using the independent samples t-test. The mean time taken for extraction in the periotome group was 7 min and 44 s and the standard deviation was 1 min and 58 s, while the mean time taken for extraction in the piezotome group was 8 min and 45 s and the standard deviation was 1 min and 59 s. The difference was statistically insignificant between the two groups (p = 0.108) [Table 3 and 4, Fig. 6].

Four. Discussion

Atraumatic dental extractions induces minimal trauma during teeth removal preserving the architecture of adjacent bone and gingiva. On the other hand, conventional dental extractions can involve reflection of a mucoperiosteal flap in combination with leverage elevation of the tooth against adjacent bone to assist removal with forceps. This often clinically for 2 weeks after extraction.

Extraction was accomplished successfully and uneventful healing occurred in all cases of both groups with no postoperative complications. Other clinical parameters including time taken for extraction, loss of marginal bone, and postoperative pain were recorded.

Mild postoperative pain was experienced by patients of both groups following the wear off of the local anesthetic effect. This pain was easily manageable by over the counter analgesics. Pain was completely resolved by the third postoperative day in all patients.
leads to fracture or deformity of the dentoalveolar area in addition to traumatizing delicate gingival papillae, consequently, impeding successful implant placement. Various forms of atraumatic techniques have gained popularity to become a standard procedure for tooth extraction [6].

A method to decrease trauma to dentoalveolar housing during tooth extraction is through using the periotome. Periotomes are instruments that utilize wedging and severing to facilitate tooth extraction [7]. A periotome looks like a combination between a miniscalpel and a miniature elevator which comprise very thin metallic blade that is inserted in the periodontal ligament (PDL) space. The instrument utilizes gentle downward wedging towards the apex of the root in a repetitive oscillating manner [8].

When these fibers are severed, extraction of the tooth with minimal lateral pressure is permitted by simple rotational movements using the forceps [9]. Additionally, the enveloping soft tissue has not been affected by an incision or iatrogenic trauma. The drawbacks of this technique are the lengthy procedure of the extraction as well as the operator fatigue.

Similarly, White et al. [10] introduced automated periotome as a useful device for atraumatic dental extractions. By avoiding reflection of a mucoperiosteal flap and injury to adjacent bone, gingival papillae were conserved giving prospect for future or immediate dental implant treatment.

Piezoelectric surgery has been used since 1988 with many improvements on the device. It provides ultrasonic frequency of 24–29 kHz, and a microvibration amplitude between 60 and 200 mm/s. It allows precise cutting of bone with a clean, minimal bloody field and without soft tissue damage [11,12]. A recent systematic review by Troedhan et al. [13] has revealed that piezotomes exerts minimal thermal damage on bone, enhanced bone healing, least destruction of bone due superior depth-control and accurate osteotomy cuts as well as protection to the soft tissue. However, they still have some disadvantages including longer surgical time and high cost of the armamentarium.

To our knowledge, the current study is the first clinical trial comparing the periotome to the piezotome in atraumatic extraction of non-restorable endodontically treated teeth.

Endodontically treated teeth may be indicated for extraction due to non-restorable caries, vertical root fractures, failed root canal treatment or iatrogenic perforations [14]. Atraumatic dental extraction of such teeth is necessary to remove the whole tooth structure and preserve the surrounding alveolar bone for subsequent implant placement.

In this study all extractions were successful with no buccal plate fracture or root fracture in both groups. There was no need for mucoperiosteal flap and bone exposure. Similar findings were noticed by Sharama D et al. [15] who compared conventional methods of extraction to periotome extraction. They noticed that buccal cortical plate fracture and apical third fracture was very minor in the periotome extraction compared to the conventional extraction.

Our results show that healing was uneventful in all cases with no postoperative complications and only mild postoperative pain was experienced by patients of both groups which was completely resolved by the third postoperative day in all patients.

This was similar to the results with Sharama D et al. [15] who conducted that the use of periotome reduced post extraction discomfort. Since the frequency and number of analgesics consumed were less than in the conventional extraction. Also, their study stated that the reduction in pain and gingival laceration favored the use of periotome.

Concerning the piezotome, Tsai et al. [16] have investigated the outcome of piezoelectric instruments on healing of alveolar sockets after extraction of mandibular third molars. Comparing extractions using piezoelectric instruments to conventional instruments, it was found that the attachment level at the distal side of the mandibular second molar was more enhanced with piezoelectric instruments one month after extraction. This supports our results in which less marginal

<table>
<thead>
<tr>
<th>Time taken for extraction</th>
<th>t-test for Equality of Means</th>
<th>Std. Error Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>Mean Difference</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.108</td>
<td>−0.01:00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.108</td>
<td>−0.01:00</td>
</tr>
</tbody>
</table>

**Fig. 6.** Time taken for extraction in both groups.
bone loss was found in the piezotome group.

Additionally, a meta-analysis by Al-Moraissi et al. showed that the occurrence of postoperative complications including pain, oedema, and trismus were greatly minimized with the piezoelectric surgery when compared to the conventional rotary instrument technique in lower third molar surgery. Moreover, the total number of analgesics consumed was lesser with piezosurgery. The only disadvantage faced was the extended time of the piezoelectric surgery. This is consistent with our results in which piezosurgery was associated with better preservation of marginal bone but longer time was needed for extraction of endodontically treated teeth in comparison to the periosteum [17]. The length of time in our study was (numerically but not statistically) slightly higher when comparing the piezotome to the periosteum. This slight difference may be attributed to using different tips for the various tooth surfaces with subsequent repeated removal and insertion of tips when changing from one tooth surface to another.

In conclusion, the results of this clinical trial revealed that both the periosteum and piezotome are good choices for atraumatic dental extraction of endodontically treated teeth, with the piezotome proving more efficient in reducing the marginal bone loss, thus providing better bone preservation for subsequent tooth replacement.

Conflicts of interest

The authors declare that they have no conflict of interest.

References