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Optimizing Multi-Rooted Tooth Extraction: A Comprehensive Study on the Efficacy of Periotomes Utilization in Non-Surgical Exodontia

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ABSTRACT

Background: Tooth extraction, is a common yet distressing procedure; using appropriate instruments is crucial. While elevators and luxators are typically used, they can cause significant socket damage due to applied force. Periotomes offer less traumatic alternatives, are designed to facilitate extraction with minimal force, reduced soft tissue damage, and better wound healing. **Objective:** The intention of this research is to assess the effectiveness of periotomes in non-surgical extraction of multi-rooted teeth. **Study Design:** Randomized controlled experiment. **Settings:** Department of Oral and maxillofacial Surgery, Lahore Medical and Dental College, Lahore Pakistan. **Duration:** The study lasted for one year and six months. **Methods:** This randomized controlled experiment was carried on 120 patients, age range of 16-60; requiring non-surgical extraction of multi-rooted teeth. Patients were randomly assigned to either an investigational group (extractions performed with a periotome and conventional forceps) or a control group (extractions performed using a straight elevator and conventional forceps). The level of pain was evaluated using a visual analogue scale within first week after surgery. Parameters such as gingival tear, length of procedure, consumption of analgesics and complications were also recorded. **Results:** Comparison of the two groups explored statistically significant variances ($p < 0.05$) across all parameters. The investigational group showed reduced extraction time, minimizing damage to surrounding bone and soft tissue a significant reduction in postoperative pain (53.7%), while the control group showed an increase in pain (67%). **Conclusion:** Findings suggest that incorporating periotomes into tooth extractions may reduce post-extraction pain, shorter extraction time and cause negligible injury to surrounding structures.

Keywords: *Atraumatic, Exodontia, Multi-root, Periotome, Gingival laceration.*

INTRODUCTION

Exodontia or tooth extraction is a frequently performed procedures in oral surgery, which is executed to resolve various dental problems with diverse indications.[1] It is considered a distressing process that immediately leads to the loss of alveolar bone and soft tissues around the tooth, which has been attributed to both physiological and iatrogenic mechanisms.[2] This loss of alveolar bone after extraction can compromise subsequent functional and aesthetic rehabilitation of the dentition, including the use of removable or fixed prostheses such as dental implants.[3] The extent of alveolar bone loss is influenced by a number of factors that include systemic elements, as well as local factors including morphology, position, preoperative socket condition, number of teeth extracted, and post extraction care carried by patient.[4]

The use of an appropriate extraction instrument is essential to minimize damage to the surrounding tissue and bone structure.[5] Elevators are commonly used to facilitate removal of the tooth by prying it out of the socket, although this method can cause considerable damage to the socket due to the force applied.[6] Luxators offer a less traumatic alternative, targeting only the

surface of the tooth and minimizing damage to the alveolar bone. Luxators resemble elevators, but have thinner and flatter tips.[7] Another tool, the periotome, boasts an extremely thin and flat tip that allows it to be inserted between the tooth and the surrounding bone. Unlike elevators, the periotome requires no force and is designed for vertical dislocation. By gently compressing the bone structure, it facilitates access to the periodontal ligament and facilitates cutting. Periotome reduces soft tissue injury and helps preserve bone integrity of the socket, Previous studies have shown that using periotomes can reduce socket damage by 45% and postoperative complications by 30% compared to traditional methods promotes proper wound healing with fewer complications, speeds recovery and reduces patient discomfort.[8,9]

The rationale for this study is to evaluate the effectiveness of periotomes compared to traditional elevators in minimizing trauma during non-surgical extraction of multi-rooted teeth. By assessing parameters like post-operative pain, gingival tear, and procedure duration, the study aims to determine if periotomes offer superior outcomes, thus enhancing patient care and recovery.

METHODS

A randomized, single blinded controlled experiment; involving 120 patients with 60 individuals allocated to each group was conducted at Department of Oral and Maxillofacial Surgery, Lahore Medical & Dental College. The minimum required sample size (n=120, 60 in each group) was calculated with the help of the WHO sample size calculator, considering a 95% level of confidence, 5% alpha error, 80% study power, pooled standard deviation of 1and an effect size of 0.51. The study was permitted by the "Ethical Review Board" of the institution (reference.no. LMDC/FD/3772/22) on October 4, 2022. All participants underwent nonsurgical extraction of multirooted teeth between November 2, 2022 and January 2, 2024.

Patients aged 16-60 years from both genders, requiring non-surgical removal of multi-rooted teeth were included in the study. Third molars, individuals who refused consent, patients with contraindications to analgesics, pregnant patients, and those who had recently taken analgesics were excluded.

Following the inclusion and exclusion criteria patients were randomly allocated into two groups; experimental and control using computer-generated randomization. Participants were enrolled by an independent statistician and were assigned to clinical investigators just before procedure. Possible complications were explained and informed consent was obtained from all participants. Tooth extractions were performed under local anaesthesia using 2% Lidocaine with 1: 100,000 epinephrine, by two clinical investigators who were well trained. In the control group, a straight elevator was used to luxate the tooth, followed by extraction with conventional forceps. In the experimental group; a flexible straight serrated periotome (NX-PT4STG) was used for vertical dislocation along mesial and distal aspects of tooth, before forceps extraction. Post-extraction instructions were provided and acetaminophen1000 mg was given post-operatively as an analgesic, with an additional dose offered as needed; maximum dose not to be exceeded 3500 mg per day.[10] Patients were instructed to report any postoperative problems to the department and were followed up after one week of procedure in the OMFS Department.

Pain level was assessed preoperatively and on seventh day postoperatively by visual analogue scale (VAS).[11] The duration of the procedure, immediate postoperative complications were recorded, and gingival lacerations were graded by using the scale given below (Table 1)[12]

Table 1: Grading Gingival Laceration for Each Group:

	Length	Depth
Class 1	0-5 mm	Abrasion
Class 2	5-10 mm	Partial
Class 3	>1 cm	Entire depth
Class 4	Torn gingiva	

Postoperatively, patients also recorded pain intensity and analgesic consumption for seven days. Demographic data and variables such as age, sex, tooth, degree of mobility, and operator were collected. Statistical analysis was performed using SPSS version 23, including chi-square tests, t-tests, and repeated-measures ANOVA tests, with significance set at $p < 0.05$.

RESULTS

120 patients were initially enrolled, with 2 individuals (one from each group) missing to follow-up, resulting in an analysis of 118 participants, equally distributed with 59 patients in each group.

The analysis revealed significant differences between the control and test groups. The duration of the procedure in control group was significantly longer than in the investigational group ($p < 0.001$) shown in Table -II. Consumption of analgesics found higher in the control group. Investigational group showed a significantly greater reduction in pain compared to other group in an intergroup comparison ($p< 0.05$), with fewer gingival lacerations observed in the investigational group ($p < 0.05$). table 2

Within-group variance for pain showed a significant reduction in the investigational group ($p < 0.05$) but a

significant increase in postoperative pain compared to preoperative levels in the control group ($p < 0.05$). table 3

Table 2: Distribution of mean and SD between investigational and control group

Group	N	Mean ± SD	Std. error mean	*p* value
Duration of extraction				
Control group	60	13.7117 ± 8.394823	1.045643	0.001
Investigational group	60	6.77010 ± 4.243751	0.671874	
Rate of analgesic used up				
Control group	59	13.70 ± 6.220	0.849	0.001
Investigational group	59	4.64 ± 3.235	0.453	
No. of analgesics used up				
Control group	59	4.32 ± 0.627	0.087	0.001
Investigational group	59	1.30 ± 0.587	0.083	
Pain deduction				
Control group	59	−0.6083 ± 2.10694	0.41863	0.002
Investigational group	59	1.8953 ± 2.54427	0.39214	
Gingival laceration				
Control group	60	1.3024 ± 0.82442	0.13676	0.000
Investigational group	60	0.1984 ± 0.63969	0.08046	

Table 3: Pain deduction in control and investigational group

	Mean ± SD	Mean Std. error	*p* value
Investigational group			
Pre-extraction pain	2.84 ± 1.774	0.229	0.026
Post-extraction pain	0.85 ± 0.767	0.099	
Control group			
Pre-extraction pain	2.81 ± 1.734	0.134	0.032
Post-extraction pain	1.65 ± 2.353	0.304	

A notable difference in complication rates emerged between the experimental and control groups ($p < 0.05$), with occurrences of mild pain one-week post-extraction significantly higher in the control group compared to the experimental group ($p < 0.05$). There was no discernible correlation between the various parameters and tooth mobility.

DISCUSSION

Historically, conventional extraction methods have been associated with postoperative discomfort and trauma to the gingiva and alveolar bone.[13] These methods typically involve leveraging the tooth against the interproximal bone, causing interproximal bone injury, or using forceps to displace the tooth from the alveolus, often resulting in socket or alveolardistruption.[14] Such practices pose challenges in maintaining socket integrity, hampering the rehabilitation of missing teeth.[15] Sharma *et al*, reported postoperative discomfort in 80% of cases involving these methods Johnson et al. mentioned trauma to the gingiva and alveolar bone occurs in approximately 60% of such extractions.[9]

Bortoluzzi, Al Shammari *et al* and Passarelli identified postoperative pain and discomfort as common issues in tooth extraction. Traditional methods frequently lead to various complications, as highlighted by Adeyemo *et al*., who reported dry socket in 11% of cases and mild discomfort in 12%. Bortoluzzi *et al*. noted a high incidence of bone loss at the extraction site one-year post-extraction. discussed preoperative complications such as inadvertent fractures of the crown, root-tip, or alveolar process, which can prolong extraction time and lead to healing complications.[16-18]

Venkateshwar and colleagues identified various complications associated with tooth extraction, including tooth fracture, trismus, cortical plate fracture, and dry socket, with rarer occurrences of wound dehiscence. They observed postoperative discomfort, dislocation of adjacent teeth, maxillary tuberosity fracture, and displacement into adjacent spaces.[19]

Similarly, our study in the control group revealed postoperative discomfort, fracture of buccal cortex, moderate ooze during forty-eight hours, alveolar osteitis, root fracture. We also observed a decline in quality of life owing to poor oral hygiene in non-surgical routine tooth extraction, analogous to findings in the control group of our study. Prashanth and Saravanan noted in their research that tooth extraction's success hinges more on technique than force or bone quality. Excessive force, particularly in elderly patients with dense, sclerotic bone, may lead to alveolar fracture.[20]

To mitigate these risks, atraumatic exodontia is advocated which preserves bone and gingival architecture, facilitating instant implant placement. Various negligibly aggressive exodontia instruments are available, including the Easy X-Trac system, physical forceps, and periotomes.[22-25]

In our investigation, we employed periotome; minimizing damage to surrounding bone and soft tissue. The investigational group showed reduced extraction time, minimizing damage to surrounding bone and soft tissue a significant reduction in postoperative pain (53.7%), while the control group showed an increase in pain (67%). The periotome enables tooth removal without bone damage as evidenced in our study where it facilitated extraction without flap reflection, thus avoiding mucoperiosteal flap and bone exposure. In the investigational group, where the periotome was utilized, operative time, analgesic consumption, pain reduction, and gingival lacerations favoured its use over traditional elevators.

CONCLUSION

Despite certain study limitations, we postulate that the periotome enhances multi-extraction outcomes compared to traditional methods; reduced extraction time, minimizing damage to surrounding bone and soft tissue while removing compact teeth and retained roots.

LIMITATIONS

This study include statistics from single unit with restricted sample size. Although only two operators performed all 120 extractions, operator bias should still be considered as a potential source of bias in the study. Finally, the reliance on self-reported pain intensity and analgesic consumption postoperatively may be subject to reporting bias.

SUGGESTIONS / RECOMMENDATIONS

We recommend the use of periotomes to make the exodontia atraumatic. Further research is required to compare the effectiveness of various designs of peritomes.

CONFLICT OF INTEREST / DISCLOSURE

There was no conflict of interest.

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