

Efficacy of Perirotome Versus Conventional Forceps Extraction in Socket Preservation and Reduction of Postoperative Pain: A Randomised Clinical Trial

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ABSTRACT

Introduction: Atraumatic extraction is necessary when a patient undergoes dental implant rehabilitation. Various tooth extraction systems are used and regularly upgraded. The perirotome is a tool that severs the Periodontal Ligaments (PDL) and aids in atraumatic extraction while preserving the socket.

Aim: To evaluate the efficacy of conventional forceps versus perirotome extractions of single-rooted maxillary teeth in terms of socket preservation, procedure duration, and postoperative pain.

Materials and Methods: This was a single-blinded randomised clinical trial conducted at Department of Oral and Maxillofacial Surgery, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India from December 2020 to March 2021 involved 42 patients aged 18-60 years who required extraction of maxillary single-rooted teeth that had failed endodontic treatment. The patients were randomly divided into two groups: a perirotome group and a

conventional forceps group. Clinical assessment was conducted to evaluate socket preservation, extraction time, postoperative pain, and any complications related to the extraction procedure. Statistical analysis was performed using the Mann-Whitney U test, Chi-square test, and unpaired t-test.

Results: The majority of patients were within the age group of 51-60 years, with 13 males and 29 females. The difference in extraction time between the two groups was not statistically significant ($p=0.368$). The perirotome group exhibited a significantly lower incidence of buccal cortical plate fractures compared to the conventional forceps group ($p=0.048$). Regarding the severity of postoperative pain, the perirotome group demonstrated a significantly lower value than the conventional forceps group ($p=0.028$).

Conclusion: The perirotome proved to be a more efficient choice for preserving the socket in endodontically non treatable teeth requiring extraction, as compared to conventional forceps.

Keywords: Anaesthesia, Atraumatic extraction, Exodontia, Painless extraction

INTRODUCTION

Removal of a tooth from the socket is known as dental extraction. In oral surgery, extraction is the most common procedure performed and frequently the first procedure performed by a budding dentist on a patient [1]. Ideal tooth extraction may be defined as the painless removal of the whole tooth or tooth roots with minimal trauma to the investing tissues so that the wound heals uneventfully with no postoperative prosthetic problems [2]. Achieving ideal exodontia may sometimes involve fracturing or surgical removal of surrounding bone. Trauma to the dentoalveolar housing during extraction causes significant ridge abnormalities. Traditional fixed partial dentures may have food entrapped in the subpontic area, in addition to poor dental implant placement and aesthetics [3].

"Atraumatic" and "Painless" dental extraction techniques have gained popularity and are becoming the standard for tooth extraction procedures. Not only do they preserve bone and gingival architecture, but they also offer the option of immediate or future dental implant placement [4,5]. Physics forceps, perirotomes, proximators, and Benex Extractors are some tools and techniques proposed for minimally invasive tooth removal [3]. Conventional forceps are two first-class levers, connected with a hinge whose handles work as long sides of levers, while the beaks are the short side of the lever, and the hinge acts as a fulcrum. The force on the handles is magnified to allow the forceps to grasp the tooth with great force. However, these magnified forces are not used for tooth removal. Instead, they may crush the tooth structure and investing

tissues. The handles of the forceps allow the operator to hold the tooth but provide no mechanical advantage for its removal [6].

Perirotomes employ the mechanisms of "wedging" and "severing" to facilitate tooth removal [7,8]. Perirotomes are made of a very thin metallic blades that are gently wedged down the PDL space in a repetitive circumferential fashion [Table/Fig-1].



[Table/Fig-1]: Application of Perirotome into the PDL space.

Periostome blade in addition to providing minimal luxation, severs the Sharpey's fibres that secure the tooth within the socket. Immediate implant placement can be done into the extraction socket, which has an undamaged alveolus and well-preserved soft tissue [9]. Additionally, surgical extrusion by periostome prevents relapse in cases of orthodontic extrusions. The use of periostome also avoids complications such as uneven gingival margins and interdental papilla loss. The blade of the periostome luxates the tooth when placed into the PDL space and manipulated in a "walking motion" [1,10-14].

This study aimed to compare the effectiveness of periostome and conventional root forceps in non restorable root piece extractions in terms of labial/buccal cortical plate preservation (socket preservation), operating time, and postoperative sequelae.

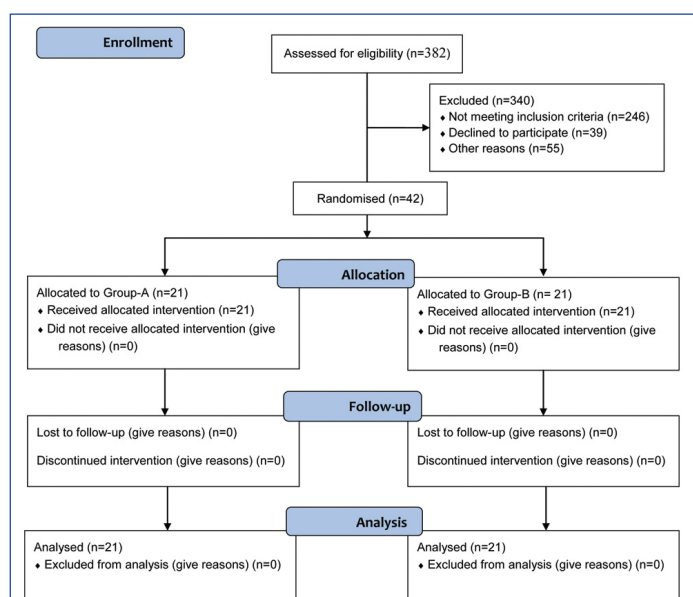
MATERIALS AND METHODS

This was a single-blinded randomised clinical trial conducted at Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India from December 2020 to March 2021. The study received approval from the Institutional Ethics Committee (IEC) (DYPDCH/IEC/164/164/20). The trial registration number is CTRI/2022/03/041434.

Inclusion criteria: The study included patients between the ages of 18 and 60 years with single-rooted maxillary teeth that could not be saved using endodontic treatment.

Exclusion criteria: Patients with periapical pathologies, tooth mobility, dilacerated roots, and systemic conditions were excluded from the study.

Sample size calculation: A sample of 42 single-rooted teeth was derived from a previous article [15] using G Power version 3.1 software. A total of 382 patients were screened, and 42 were selected based on the inclusion criteria. These 42 teeth were divided into two groups of 21 each: Group A (Periostome) and Group B (Conventional Root Forceps). Patient allocation to each group was done using the Sequentially Numbered Opaque Sealed Envelopes (SNOSE) method. Opaque sealed envelopes containing group names were presented to all the participants by the operator, and the patients were allocated according to their choice of envelope [Table/Fig-2].



[Table/Fig-2]: Consolidated Standards of Reporting Trials (CONSORT) 2010 flow diagram.

Study Procedure

The procedure was performed by a trained professional proficient in both techniques. Written informed consent was obtained from all participants. The patient was briefed about the procedure and the Visual Analogue Scale (VAS), which was used to measure pain

immediately after the operation. Local anaesthesia (2% lignocaine with 1:200,000 adrenaline) was administered through subperiosteal infiltration using a 30 Gauge, 1.5 inch long needle specific to the tooth being treated.

For patients assigned to Group A (Periostome), a Periostome was used to cut the gingival and periodontal fibres by employing a "Walking Motion" technique to loosen the tooth. Once the tooth was dislodged, appropriate forceps were used to extract it with minimal rotation and a gentle coronal pulling motion. Haemostasis was achieved by applying a pressure pack.

For patients assigned to Group B (Conventional Root Forceps), the periosteum was separated using the moon's probe. Conventional root forceps were then used with minimal bucco-palatal and rotational movements. Tooth extraction was performed by applying a coronal pulling motion, and haemostasis was achieved using a pressure pack.

All patients were evaluated for immediate postoperative socket preservation. A periodontal probe was used to check the patency of the labial/buccal cortical plate to assess socket preservation. The time taken for the procedure was measured using a stopwatch, starting from the initiation of the procedure (application of periostome/conventional root forceps). After applying a pressure pack, postoperative instructions were provided to the patient. Pain levels were recorded using the VAS, a numerical scale ranging from 0 to 10 [16]. A VAS score of 0-3 indicates mild pain, 4-7 indicates moderate pain, and 8-10 indicates severe pain. In case of patient discomfort, a 650 mg tablet of Paracetamol was prescribed, and patients were instructed to keep a record of the number of tablets consumed. On Postoperative Day (POD) 1 and 7, any rescue medicine taken was noted.

STATISTICAL ANALYSIS

Statistical analysis was performed using G Power version 3.1 software. The Mann-Whitney U test was utilised to compare the pain experienced in both groups. The Chi-square test was applied to compare the use of rescue medicine and socket preservation between the groups. An unpaired t-test was used to compare the duration of the procedure in both groups. A significance level of $p \leq 0.05$ was considered statistically significant.

RESULTS

Out of the 42 patients enrolled in the study based on the inclusion and exclusion criteria, 13 were males and 29 were females. The majority of patients fell within the age group of 51-60 years. The most frequent tooth extractions were performed on tooth numbers 11, 13, 21, and 25.

In 2 cases (9.5%) using the Periostome, the extraction time was less than one minute, in 15 cases (71.4%) it ranged from 1-3 minutes, and in 4 cases (19.1%) it exceeded three minutes. When using conventional root forceps, the extraction time was less than one minute in 1 case (4.8%), between 1-3 minutes in 17 cases (81%), and exceeded three minutes in 3 cases (14.2%) [Table/Fig-3]. In Group A, where the Periostome was used, socket preservation was achieved in 100% of cases. In Group B, where conventional root forceps were used, socket preservation was achieved in 16 cases (76.2%), while 5 cases (23.8%) experienced damage to the buccal cortical plate. A significantly higher number of participants (N=7) in Group B consumed rescue medicine on day 1 compared to the periostome group ($p=0.009$) [Table/Fig-4]. No rescue analgesic was required in either group on POD 7 (N=0).

In Group A, 12 patients (57.1%) experienced mild pain (VAS score 0-3), 6 patients (28.6%) experienced moderate pain (VAS score 4-7), and 3 patients (14.3%) experienced severe pain (VAS score 8-10). In Group B, 4 patients (19%) experienced mild pain, 12 patients (57.2%) experienced moderate pain, and 5 patients (23.8%) experienced severe pain [Table/Fig-3]. The pain was significantly

Variables		Periotope		Conventional root forceps	
		n	%	n	%
Time taken	<1 min	2	9.50	1	4.80
	1-3 mins	15	71.40	17	81
	>3 mins	4	19.10	3	14.20
Socket preserved	Yes	21	100	16	76.20
	No	0	0	5	23.80
Post extraction pain	Mild pain	12	57.10	4	19.1
	Moderate pain	6	28.60	12	57.1
	Severe pain	3	14.30	5	23.80

[Table/Fig-3]: Distribution of patients according to time consumed, socket preserved, and postextraction pain amongst two groups (N=42).

Variables		Periotope		Conventional root forceps		Chi-square value	p-value
		N	%	N	%		
Socket preserved	Yes	21	100	16	76.2	5.676	0.048*
	No	0	0	5	23.8		
Rescue medicine taken on day 1	Yes	0	0	7	33.3	8.4	0.009*
	No	21	100	14	66.7		

[Table/Fig-4]: Chi-square test for association of the type of instrument used with socket preservation and rescue medicine taken (N=42).

higher in the conventional forceps group ($p=0.028$) [Table/Fig-5]. The mean extraction time was shorter in the periotope group, but the difference was not statistically significant ($p>0.05$) [Table/Fig-6]. No other major complications were reported in either group.

Group	N	Mean rank	p-value
Periotope	21	17.64	0.028*
Conventional	21	25.36	

[Table/Fig-5]: Mann-Whitney U test to assess the difference in the level of pain experienced for different instruments (N=42).

Groups	N	Mean	SD	t-value	CI	p-value
Periotope	21	1.87	0.99	-0.91	-0.91 to 0.344	0.368
Conventional	21	2.15	1.02			

[Table/Fig-6]: Unpaired t-test to assess the difference in time (min) consumed between the two types of instruments (N=42).
SD: Standard deviation; CI: Confidence interval

DISCUSSION

Alveolar ridge resorption is an inevitable consequence following tooth extraction [17]. Achieving an atraumatic extraction provides a clinical advantage in preprosthetic preparations by preserving the alveolar ridge and surrounding soft tissue. The first six months following extraction are crucial in terms of ridge resorption and future restoration [18]. Different atraumatic extraction methods are employed to preserve the soft tissue and alveolar ridge of the extraction socket for immediate implant planning. Fracture of the buccal, lingual, or palatal cortical plate occurs during extraction using forceps and applying mesiodistal rotation to the tooth, which can traumatise the soft tissue and bone [18].

Severing the fibres surrounding the tooth prior to extraction can minimise soft tissue injury and promote faster healing. The use of a Periotope is based on this principle. It features a long, thin blade that engages the space between the tooth and surrounding soft tissue within the socket, effectively severing the investing fibres from the tooth structure and facilitating easier luxation of the tooth [19]. Therefore, in the present study, the efficacy of the Periotope was assessed using three parameters. Previous literature had the drawback of procedures being performed by multiple operating surgeons [17], which has been addressed in this study.

Postoperative pain is the most commonly assessed parameter in extraction procedures [20]. It reflects the damage caused to the

investing tissue during extraction. In this study, the VAS score was lower when the Periotope was used. This finding is consistent with the study by Sharma SD et al., [17]. The reason for less pain in the Periotope group may be attributed to reduced damage to the surrounding hard and soft tissues.

The time required for extraction using conventional forceps and the Periotope was measured using a stopwatch. It was found that there was no significant difference in the extraction time between the two groups, with a non-statistically significant p-value. This may be due to the slow and precise nature of the Periotope technique, which requires careful handling of the tissues by the operator. Another important parameter assessed in the present study was socket preservation, specifically noting whether only the buccal cortical plate was preserved. A case report by Tay ZW et al., highlighted dentoalveolar fracture as a complication during tooth extraction [21]. The results of the present study using the Periotope showed that socket preservation was achieved in 100% of cases in the test group. These findings are consistent with another study [15].

The Periotope is an instrument that utilises principles of wedging and severing to facilitate tooth extraction. It functions as a combination of a mini-scalpel, cutting through gingival and periodontal fibres, and a miniature elevator, luxating the tooth by creating space between the tooth and the socket [22]. However, a drawback of using the Periotope in atraumatic extraction is the lengthy procedure time and the potential for operator fatigue [22]. The Periotope allows for atraumatic extraction by preserving the gingival tissues and alveolar bone surrounding the tooth. Proper handling of the Periotope is crucial, as its tip is thin and sharp, and improper handling can result in the penetration of the Periotope into the maxillary sinus or nasal floor during maxillary tooth extraction [23].

Limitation(s)

The present study did not take into consideration operator fatigue during the extraction process, which can potentially lead to iatrogenic trauma to the surrounding structures.

CONCLUSION(S)

The study's findings indicate that the Periotope is the preferred option due to better socket preservation, reduced postoperative pain, and decreased need for rescue medication. Additionally, patients in the Periotope group reported a better postoperative pain experience compared to those in the conventional root forceps group. Therefore, it can be concluded that the Periotope is more effective than conventional root forceps for extracting maxillary single-rooted teeth. The key takeaway message is that severing the fibres of a tooth using the Periotope results in less resorption of the crestal bone.

Author's contribution: Murtaza M Contractor data collection, manuscript writing; Kalyani Bhate study concept or design, manuscript editing and reviewing; Uday Londe data analysis, manuscript editing; Sayali Awate manuscript editing; Adnan Chhatrivala manuscript writing; Sherwin Samuel data analysis manuscript writing.

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