Comparison Between Luxators and Periotomes in Atraumatic Non-Surgical Extraction of Single Rooted Maxillary and Mandibular Teeth- A Double Blind Randomised Controlled Trial

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KEYWORDS
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ABSTRACT

Introduction: Atraumatic extraction plays an important role when it comes to dental implant rehabilitation. As there are various tooth extraction systems are used and regularly upgraded.

Aim: To evaluate the efficacy of luxators versus periotomes as an aid to atraumatic non-surgical extraction of single rooted maxillary and mandibular teeth in terms of buccal/labial cortical plate preservation, procedure duration, postoperative pain and soft tissue injury.

Materials And Methods: A double blind, randomised controlled clinical trial conducted at Department of Oral and Maxillofacial Surgery, Karpaga Vinayaga Institute of Dental Sciences, Chengalpet, India from April 2023 to November 2024 involved 123 patients aged 18-60 years who required extraction of maxillary and mandibular single rooted teeth were included. The subjects were randomised into group A (underwent extraction with luxators and conventional extraction forceps) and group B (underwent extraction with periotomes and conventional extraction forceps). Clinical assessment was conducted to evaluate post operative pain, duration of operation and soft tissue injury. Statistical analysis was performed using Chi square test and independent t-test.

Results: The majority of patients were within the age group of 40-55 years, with 68 males and 52 females. Both the groups reported significantly ($p \leq 0.005$) higher visual analogue score at Day 0 and 3. On intergroup comparison shows statistically significant at Day 0, 3rd and 5th day. The mean operation time was found to be 15.92±3.61 in Group A and 15.82±2.11 in Group B but these differences were not statistically significant ($p=0.866$). However, fewer soft tissue laceration were observed with periotome of <5mm length (grade I) whereas with luxators the grading found to be increased (Grade II &III) and found to be statistically insignificant ($p<0.005$).

Conclusion: The use of periotomes along with conventional extraction forceps proved to be more efficient choice for non-surgical extraction of single rooted maxillary and mandibular teeth.

1. 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 first procedure performed by a budding dentist on a patient (1). Extraction must be done in less traumatic manner so that the site heals uneventfully and can be used in an effective manner for prosthetic rehabilitation. Conventional extraction involves elevation of mucoperiosteal flap and widening of periodontal ligament fibres and then the extraction of teeth using conventional forceps. There may be fracture of buccal cortical bone plate on involved side because of which the healing period is delayed. In order to overcome these, a very minimally traumatic or atraumatic method of extraction methods are employed. Atraumatic extractions include extractions for orthodontic treatment, implant placement, medically compromised individuals, retained deciduous teeth.[2] There are many kinds of instruments such as luxators, Periotomes, Physics forceps,

Proximators, Benex extractors, piezosurgery, X-Trac system which are used in recent times to aid in minimally traumatic extraction methods [3].

Luxators are designed in such a way that they can be wedged into the periodontal ligament space between tooth and it's surrounding bone. It should be inserted around the circumference of the tooth as much as possible to evenly dilate the socket and advanced with a side to side rocking motion and steady axial pressure in order to remove tooth from socket [5].

Whereas Periotomes are instruments placed in periodontal ligament space with vertical pressure along long axis of root. They are inserted at an angle of 20 degrees to the long axis of tooth to enter into gingival sulcus and advanced into periodontal ligament space, thereby severing gingival and periodontal ligament fibres causing loosening of tooth from it's socket [9].

This study was undertaken to compare the efficacy of Luxators and periotomes in atraumatic non-surgical extraction of single rooted maxillary and mandibular teeth without using periosteal elevator for elevation of mucoperiosteal flap in terms of labial/buccal cortical plate preservation, post operative pain, soft tissue injury and operative duration.

2. Materials and Methods

A randomized, double blind, clinical trial conducted at Department of Oral and Maxillofacial Surgery was performed in 100 patients. All patients underwent atraumatic non-surgical extraction of single rooted maxillary and mandibular teeth between 2023(April)-2024(September). The study was approved by the Research and Ethics Committee of the institution (IEC NO. KIDS/IEC/2024/II/021). Before enrolment, the objectives, and possible complications were explained to all the patients and informed consent were obtained. Inclusion criteria included patients above 14 and 60 years of age requiring nonsurgical removal of either maxillary or mandibular single rooted tooth. Exclusion criteria includes patients with periapical pathologies, tooth mobility, refusal of informed consent, patients already under medications, allergy to ibuprofen, pregnant patients and history of intake of analgesics up to 10 days prior to extraction. Demographic data including patient name, age, sex, diagnosis were recorded.

A sample of 26 patients per group derived from previous article using G power software version 3.1. A total of 123 patients were screened and 110 were selected based on inclusion criteria. These 110 teeth were divided into two groups of 55 each were divided into Group A (Using luxators and conventional extraction forceps) Fig 1., and Group B (Using periotome and conventional extraction forceps) Fig 2. 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. The principal investigator is responsible for post operative follow up. Blinding of participants and operator done.

Investigator decides the duration and dosage of analgesics. Paracetamol 650 mg was given immediately after completion of extraction and for three days. Patients were followed-up for a minimum period of 1 week for evaluation of extraction socket. During the intraoperative phase, duration of procedure was calculated from the onset of local anaesthesia till the completion of tooth extraction using stopwatch. Soft tissue injury like gingival laceration were graded based on length and depth depicted in Table 1.

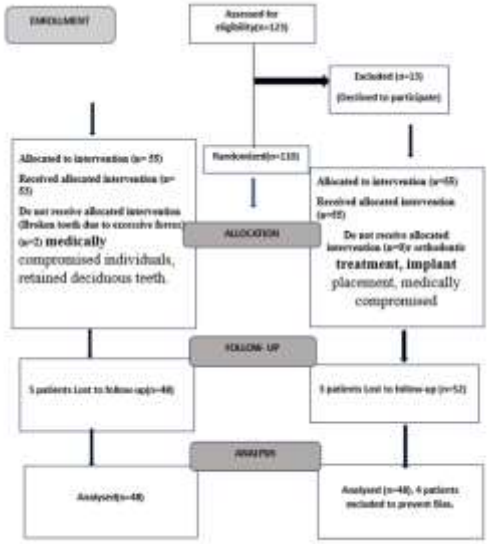

Figure 1: depicts the CONSORT flowchart

3. Result

The IBM SPSS statistics for windows v.22 was used for data entry and analysis. An independent sample T-test was used to compare the means of two groups for quantitative variables and chi-square for categorical variables. Statistical significance was set at $P \leq 0.05$. Out of the 110 patients enrolled in the study based on the inclusion and exclusion criteria, 58 were males and 52 were females. The majority of patients fell within the age group of 41-55 years. The most frequent tooth extractions were performed on tooth numbers 11, 13, 21, 25, 31, 41, 42, 45. The present trial had 100 samples that were equally and randomly allotted into periotome and luxator group. Clinical parameters were assessed using validated questionnaire. While comparing the mean pain scores in the 4 phases (0,3,5,7) according to VAS, there was a statistically significant difference between two groups in day 0, 3 & 5 except day 7 ($P>0.072$). Table. 3., The gingival laceration was relatively reduced with the use of periotome than with luxator but the values are not statistically significant which the length and depth of laceration found to be increased in luxator group. The mean clinical operating time was approximately 15 minutes for both the groups. Analgesics were used for 3 days (Dolo 650mg) in both the groups.

4. Discussion

Traditional extraction methods have a history of not only producing postoperative pain but also damaging the hard and soft tissues surrounding the tooth. Conventional extraction techniques either elevate the tooth by leveraging against the interproximal bone resulting in damage to the interproximal bone or use of forceps to luxate the tooth from its socket which often results in reshaping of the socket or alveolus. This leads to difficulty in maintaining the socket integrity due to hard tissue damage and thus making future prosthetic replacement difficult. Even the oral health related quality of life following non-surgical routine tooth extraction deteriorate with conventional method combined with usage of luxator or periotome instead of periosteal elevator due to intraoperative and postoperative complications.[1]

Atraumatic extractions comprise of those instruments and methods that use vertical rather than translational forces to extract teeth. These procedures primarily make use of devices like physics forceps, luxators, periotomes and piezoelectric instruments.[4]

Luxator are similar to an elevator, but the tip of the instrument is thinner and flatter than an elevator. One of the frequently occurring frustrating challenges when extracting teeth is breaking the tooth off

at the bone level, or extracting a tooth that is grossly decayed and at the bone level. The elevators used leverage from the surrounding tissues, hence surgical outcomes were difficult to predict. Dental luxators are instruments which look like small screwdrivers. Their design is such that they can be wedged into the ligament space between the tooth and its surrounding bone. As the elevator is forced into and twisted around in this space, the tooth is pressed and rocked against the bone. This helps to expand the socket. It also helps to separate the tooth from its ligament. As this work is continued, the tooth gradually becomes more and more mobile in its socket. In some cases, the dentist may be able to remove the tooth with just this tool completely.[6]

The periotome is an invaluable instrument in the armamentarium of any surgeons during an atraumatic extraction. This instrument helps in extracting teeth and remaining root stumps roots without injuring the surrounding housing and causes minimal or no laceration of the soft tissue. This helps in a better postoperative dental rehabilitation of the patients, including dental implant insertion. Thus, it supports the biomechanical justification for the minimally invasive technique of dental extraction. In addition, a periotome is useful in extracting difficult teeth such as the endodontically treated teeth and crown fracture cases by maintaining soft and hard tissue architecture without the need for reflecting a flap and its postoperative consequences. Extractions with periotome result in an intact alveolus and near-normal extraction socket [9]. Severing the fibres surrounding the tooth prior to extraction can minimize soft tissue injury and promote faster healing. The use of a periotome is based on this principle. It features a long, thin blade that engages the space between tooth and surrounding soft tissue within the socket effectively severing the investing fibres from tooth structure and facilitating easier luxation of tooth [8].

Here, we have used luxator and forceps in group A and periotome and forceps in group B as means of atraumatic extraction. In cases done with Luxator along with conventional extraction forceps few intraoperative complications like chipping of teeth due to excess forces and postoperative complications like dry socket and interdental bone loss were evident. Whereas in cases done with periotome and conventional extraction forceps no postoperative complications were seen. Periotome helped in removing firm tooth and retained roots without damaging the surrounding thin alveolar plates of bone and minimally lacerating the soft tissue as well. This may aid in providing a completely supportive environment for both immediate and delayed implant placement. Also periotome seemed to be helpful in maintaining the soft and hard tissue architecture specially in extracting endodontically treated teeth and crown fracture cases. It aids in removing the tooth without damaging the osseous housing. Duration of surgery, frequency and number of analgesics consumed, postoperative pain, and gingival laceration favoured the use of periotome along with conventional extraction forceps for an atraumatic nonsurgical extraction. So based on this, we are of the opinion that use of periotome along with conventional extraction forceps give a superior result than usage of luxators along with conventional extraction forceps in atraumatic nonsurgical extraction of single rooted maxillary and mandibular teeth. Periotome 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. However, a drawback of using the Periotome in atraumatic extraction is the lengthy procedure time and the potential for operator fatigue. The Periotome allows for atraumatic extraction by preserving the gingival tissues and alveolar bone surrounding the tooth.

5. Conclusion

The study's findings indicate that the Periotome along with conventional extraction forceps is the preferred option for better socket preservation, reduced postoperative pain, minimal gingival laceration and decreased need for rescue medication. Therefore, it can be concluded that the Periotome along with conventional forceps is more effective than luxators along with conventional root forceps for extracting maxillary and mandible single-rooted teeth.

Table 1: Grading of Gingival Laceration

	Grade 1	**Grade 2**	**Grade 3**	**Grade 4**
Length	0-5 mm	5-10 mm	>1 cm	Torn gingiva
Depth	Abrasion	Partial	Complete depth	

Table 2: Intragroup Comparison of Pain Score in Group a (Luxators)

TIME+ INTERVAL	**0 (NO PAIN)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8 (SEVERE PAIN)**	**CHI - SQAURE VALUE**	**CONTIGENCY COEFFICIENT VALUE**	**p VALUE**
DAY 0 (On the day of extraction)	0	0	0	0	6	20	11	9	4	391.477	0.814	0.000*
DAY 3	0	0	12	29	7	2	0	0	0			
DAY 5	17	27	5	0	1	0	0	0	0			
DAY 7	45	4	0	1	0	0	0	0	0			

P<0.005, statistically significant, Chi square test with contingency coefficient with yates correction

Table 3: Intragroup Comparison of Pain Score In Group B (Periotome)

TIME INTERVAL	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**CHI-SQUARE VALUE**	**CONTIGENCY COEFFICIENT VALUE**	**p VALUE**
DAY 0	0	0	0	0	40	9	1	437.667	0.828	0.000*
DAY 3	0	0	25	24	1	0	0			
DAY 5	29	20	1	0	0	0	0			
DAY 7	50	0	0	0	0	0	0			

*P<0.005, statistically significant, Chi square test with contingency coefficient with yates correction

Table 4: Intergroup Comparison of Pain Score Between Group A(Luxators) And B (Periotomes) – At Day 0, Day 3, Day 5, Day 7

TIME INTERVAL	**GROUPS**	**CHI-SQUARE VALUE**	**CONTINGENCY COEFFICIENT**	**p VALUE**
DAY 0	**GROUP A VS GROUP B**	50.636	0.580	0.000*
DAY 3	**GROUP A VS GROUP B**	11.539	0.322	0.009*
DAY 5	**GROUP A VS GROUP B**	7.840	0.270	0.049*
DAY 7	**GROUP A VS GROUP B**	5.263	0.224	0.072

*P<0.05, statistically significant, Chi square test with contingency coefficient with yates correction

Table 5: Intergroup Comparison of Gingival Laceration Between Group A (Luxators) And B (Periotomes)

GROUPS	1 (0-5 mm)	2 (5-10 mm)	3 (>1 cm)	4+(TORN GINGIVA)	CHI-SQUARE VALUE	CONTINGENCY COEFFICIENT	p VALUE
GROUP A	31	16	2	1	4.434	0.206	0.218
GROUP B	40	9	1	0			

*P<0.05, statistically significant, Chi square test with contingency coefficient with yates correction

Table 6: Mean Time Duration of Extraction Between Two Groups

GROUPS	MEAN ± SD	t VALUE	p VALUE
GROUP A [LUXATORS]	15.92 ± 3.61	0.169	0.866
GROUP B [PERIOTOMES]	15.82 ± 2.11		

*P<0.05, statistically significant, Unpaired t test

Figure 2: Group A – Extraction Done Using Luxator and Conventional Extraction Forceps

Figure 3: Group B – Extraction Done Using Periotome and Conventional Extraction Forceps

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