



Original Article

Use of Physics Forcep Versus Conventional Forcep in Extraction of Mandibular First Molar

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ABSTRACT

Dental extractions are common. Atraumatic extractions utilizing various technologies are said to protect paradental structures. The new physics forceps can extract the teeth without stress.

Objective: To compare the efficacy of physics versus conventional forcep in extraction of mandibular first molar. **Methods:** Patients aged 18 to 40 requiring extraction of mandibular first molar were included in the study. The efficacy of extraction was evaluated based on bone loss, soft tissue tear, time required for extraction, postoperative pains, and root fracture. The participants were divided into two groups (Physics forcep and conventional forcep) using block randomization technique, and the pain and time between both groups were compared using independent samples t-test. **Results:** The two groups had a mean age of 2.85 ± 0.355 years. Physics Forceps (n=1, 6.7%) caused less soft tissue tears than Conventional Forceps (n=14, 93.3%) ($p=0.01$). 55.5% of the Physics Forceps group and 44.5% of the Conventional Forceps group took more than 10 minutes to extract ($p=0.045$). Physics Forceps had a greater rate of complete success ($p=0.043$) than Conventional forceps ($p=0.043$). In terms of overall instrument utility, physics forceps scored better than Conventional forces in both good and average scores ($p=0.021$). The difference in mean pain score in the two groups was statistically significant ($p=0.0018$) at day 3 and day 7 ($p=0.0001$) being lower in physics forcep. **Conclusions:** Physics forceps are a more favorable substitute to traditional forceps for atraumatic tooth extraction.

INTRODUCTION

Exodontia is a common dental procedure that may result in trauma and the immediate loss of alveolar bone and surrounding soft tissue [1]. There are various reasons why a tooth may need to be extracted, such as severe decay, periodontal disease, orthodontic concerns, pre-prosthetic reasons, pre-radiation extraction, and others [2-4]. The traditional approach to tooth extraction involves creating a mucoperiosteal flap, elevating and luxating the tooth with forceps, which can result in complications like facial bone plate fracture, root fracture, post-operative pain, or

deformation of the dentoalveolar complex [5-7]. Aristotle, a well-known historical figure from 384-322 BC, identified forceps as a tool for extraction that worked by utilizing "two levers acting in anti-direction with one point fulcrum" [8]. To achieve a successful tooth extraction, a surgeon must possess finesse and the ability to apply controlled force. Traditional extraction techniques involve various methods, such as severing the periodontal ligament, using an elevator to loosen the tooth, and removing it with forceps [9]. In case the elevator technique is unsuccessful, forceps

may be employed to use intermittent apical and lateral forces to extract the tooth [10]. However, if the tooth is already weakened due to decay or endodontic treatment, or if the roots are long and/or twisted, using conventional extraction forceps can result in fracturing of the tooth or the underlying bone. This can lead to more complex surgical procedures and adverse postoperative consequences [11]. Tooth extraction has been practiced for thousands of years using mechanical force, but technological advancements have primarily aimed to preserve the tooth crown rather than enhance the extraction process [12]. Atraumatic tooth extraction has become increasingly popular in the last decade as it helps to maintain bone integrity for implant placement. The Physics forceps are a groundbreaking tool in exodontia, utilizing biomechanics with minimal squeezing, gripping, twisting, or pulling forces. Its primary approach is to utilize first-class lever, creep, and tension circulation to carry out the extraction process in a more efficient manner [13]. The main objective of atraumatic tooth extraction is to preserve the integrity of the bone while removing the tooth, minimizing any damage or trauma to the surrounding tissues [14]. In this regard, Physics forceps have gained a significant amount of attention due to their ability to extract teeth using a level 1 lever system, without requiring excessive squeezing, gripping, twisting, or pulling forces. To further investigate the effectiveness of Physics forceps in comparison to traditional forceps, a research study has been proposed. This study aims to evaluate the extraction of mandibular molars using both Physics forceps and traditional forceps, and to compare the outcomes of each method in terms of effectiveness, efficiency, and postoperative complications. By comparing the two methods, the researchers can determine if Physics forceps can be considered as a viable alternative to traditional forceps in atraumatic tooth extraction procedures. The study may also provide insights into the advantages and limitations of each method, helping to inform dental professionals on the best approach to use for different patient scenarios. Ultimately, the findings of this research may help to improve the overall quality of dental care and patient outcomes. The objective of the study was to compare the effectiveness of physics versus conventional forcep in extraction of mandibular first molar.

METHODS

This randomized clinical trial was conducted on 130 participants (65 per group) at the Department of Oral & Maxillofacial Surgery, Institute of Dentistry, Liaquat University of Medical Health & Sciences, Jamshoro using a non-probability sampling technique. After an explanation of the study aims, informed consent was obtained verbally

from all participants. The total sample size was 130 (65 in each group). The sample size for this study was calculated using the OpenEpi calculator based on the mean difference in pain after using physics forceps versus conventional forceps. Group A had a mean of 5.6, while group B had 14.3 (9). With a 95% confidence interval and 80% power, the total sample size was calculated to be 118 (59 in each group), with an additional 10% more cases to be recruited in each group to accommodate possible incomplete or missing responses. Participants aged 18 to 40 years, regardless of gender, who were willing to participate, and required extraction of mandibular 1st molar with straight root due to carious, prosthetic, or orthodontic reasons were included. Patients with uncontrolled systemic disease, pregnancy, lactating mothers, failed root canal treated teeth, abnormal root morphology (dilacerated), and periodontal compromised first permanent molars were excluded. Patients who met the inclusion criteria were included in the study. All patients were assessed clinically and radiographically according to the inclusion criteria of the study. Participants were bifurcated into two groups using block randomization technique. Each block consisted of 10 participants who were randomized into two groups by simple random technique using the "Rand function" in an Excel sheet. The efficacy of extraction was measured in term of bone loss, soft tissue tear, time required for extraction, postoperative pains and root fracture. After the achievement of effective local anesthesia, the extraction of the first molar was performed using either the physics forceps or conventional forceps. For physics forceps extraction, the instrument was placed on the buccal surface of the tooth and compressed to the root. The beak was then rotated to engage the root, and an apical force was applied to extract the tooth. On the other hand, for conventional forceps extraction, the instrument was positioned around the crown of the tooth and rocked back and forth to expand the socket. Once the socket was expanded, an apical force was applied to extract the tooth. After the tooth was extracted, the socket was inspected for any debris or bone spicules, and the patient was instructed to bite down on gauze to control bleeding. Postoperative instructions and medications were given to the patient as needed. The study collected data on several variables including age, sex, side of the mandibular first molar (right or left), presence of soft tissue tear (yes or no), time of extraction (less than 10 minutes or more than 10 minutes), success of extraction (complete success, limited success needing osteotomy, or limited success with root tip fracture), pain score on visual analog scale (at day 3 and 7) and overall utility of the instrument (scored as 1 for good, 2 for average, and 3 for poor) in both groups. Pain was evaluated postoperatively by using visual analog scale. A

score of 0 indicate "no hurt", while 10 indicate "hurts worst". Normal antibiotics (Amoxicillin 500g/8hr for 3 days) and analgesic paracetamol 1g/6hr were supplied to the patients for pain relief. The patients were advised to consume a soft diet after surgery and to use mouthwash to keep their teeth clean. The data were analyzed using SPSS version 22.0. Frequency and percentage were calculated for the categorical variables like gender, and side of mandibular 1st molar, soft tissue tear, success of extraction and utility of instruments in both groups. Mean and SD \pm was calculated for continuous variables like age, post-operative pain score and time need for extraction in both groups. Comparison of pain and time between both groups was done using independent samples t test. Chi-square test was run to compare categorical outcomes variables between two groups. $p < 0.05$ was significant level.

RESULTS

The mean age of the participants was 2.85 ± 0.355 years. The most common age group in both groups was 31-40 years. In the Physic Forceps group, 54 (84.4%) participants belonged to the 31-40 age group, while in the Conventional Forceps group, the number was 56 (87.5%). The difference between the two groups was not statistically significant ($p=0.46$). Males outnumbered females in both groups, but the difference in gender distribution between the two groups was not statistically significant ($p=0.51$) (Table 1).

Table 1: Comparison of age and gender distribution between physics and conventional forcep

variable	characteristics	Physic Forceps	Conventional Forceps	p-value*
Age (years)	21-30	10(15.6)	9(14.06)	0.46
	31-40	54(84.4)	56(87.5)	
Sex	Male	44(68.75)	38(59.37)	0.51
	Female	20(31.25)	27(42.18)	

*Chi-square test

Table 2 presents a comparison of the efficacy of Physic Forceps and Conventional Forceps. The variables analyzed include the side of mandibular 1st molar, soft tissue tear, time of extraction, success of extraction, and overall utility of the instrument. For the side of the mandibular 1st molar, the majority of participants in both groups had the lower right side extracted. The difference between the two groups was not statistically significant ($p=0.71$). Regarding the occurrence of soft tissue tears, Physic Forceps had a significantly lower incidence ($n=1$, 6.7%) than Conventional Forceps ($n=14$, 93.3%) statistically ($p=0.01$). For the time of extraction, 61 (55.5%) participants in the Physic Forcep group and 50 (44.5%) in the Conventional Forcep group had their teeth extracted in more than 10 minutes, and the difference between the two groups was statistically significant ($p=0.045$). In terms of the success of extraction,

Physic Forceps had a significantly higher rate of complete success than Conventional Forceps ($p=0.043$). However, Conventional Forceps had a higher rate of limited success through osteotomy or root tip fracture. Finally, the overall utility of the instrument was assessed, and Physic Forceps were rated significantly higher than conventional forceps in terms of both good and average scores ($p=0.021$) (Table 2).

Table 2: Comparison of efficacy of physic and conventional forceps

variable	characteristics	Physic Forceps	Conventional Forceps	p-value*
Side of Mandibular 1st molar	Lower Right	36 (47.4)	40 (52.6)	0.71
	Lower Left	28 (52.8)	25 (47.2)	
Soft Tissue Tear	Yes	1 (6.7)	14 (93.3)	0.01
	No	63 (55.8)	50 (44.2)	
Time of Extraction	>10 minutes	61 (55.5)	50 (44.5)	0.045
	<10 minutes	3 (16.7)	15 (83.3)	
Success of Extraction	Complete Success	60 (57.1)	44 (42.9)	0.043
	Limited Success (Osteotomy)	2 (11.8)	15 (88.2)	
	Limited Success (Root Tip Fracture)	2 (25)	6 (75)	
Overall Utility of Instrument	Score 1-Good	61 (56.5)	46 (43.5)	0.021
	Score 2-Average	3 (13.6)	19 (86.4)	
	Score 3-Poor	0 (0)	0 (0)	

*Fisher exact test

Table 3 is comparing the time of extraction between two interventions, Physic Forceps and Conventional Forceps. The Mean Difference with negative value (-0.18) indicates that on average, extraction time was shorter with Physic Forceps compared to Conventional Forceps. The 95% confidence interval (CI) for the mean difference (-0.296, -0.063) was statistically significant. This means that we can be 95% confident that the true difference in mean extraction time between the two interventions falls between -0.296 and -0.063 minutes. The difference was statistically significant ($p=0.0028$).

Table 3: Comparison of time of extraction between two interventions

Time of Extraction (minutes)	Mean \pm SD	Mean Diff	95% CI mean Diff	p-value*
Physic Forceps	1.05 \pm 0.21	-0.18	-0.296, -0.063	0.0028
Conventional Forceps	1.23 \pm 0.42			

*Student t test

Table 4 presents the comparison of postoperative pain scores between two interventions, Physic Forceps and Conventional Forceps, at day 3 and day 7 after the surgery. At day 3, the mean pain score was significantly lower in the group treated with Physic Forceps (2.58 ± 0.98) compared to the group treated with Conventional Forceps (3.26 ± 1.39). The difference in mean pain score between the two groups was statistically significant (p -value=0.0018).

Similarly, at day 7, the mean pain score was significantly lower in the group treated with Physic Forceps (0.21 ± 0.11) compared to the group treated with Conventional Forceps (0.92 ± 0.88). The difference in mean pain score between the two groups was also statistically significant (p -value=0.0001).

Table 4: Comparison of post operative pain score at day 3 and 7 between two interventions

variable	characteristics	Physic Forceps	Conventional Forceps	p-value*
At 3rd day	Physic Forceps	2.58±0.98	-1.1, -0.25	0.0018
	Conventional Forceps	3.26±1.39		
At 7th day	Physic Forceps	0.21±0.11	-0.93, -0.48	0.0001
	Conventional Forceps	0.92±0.88		

*Student t test

DISCUSSION

This randomized controlled trial aimed to compare the efficacy of extraction using physics versus conventional forceps. The measurements were bone loss, soft tissue tear, time required for extraction, postoperative pain, and root fracture for first molar extraction. Our findings revealed that the physics forceps were effective in terms of all variables of outcome. For a long time, traditional methods of tooth extraction have been used to forcefully remove teeth without affecting the alveolar bone or surrounding tissue. Rodd created the elevator, which uses a single lever under the tooth to push it out of its socket. However, these traditional extraction techniques often cause harm to the gingival tissue, ranging from slight laceration to complete destruction of the buccal bony layer and interdental bone crest [15]. As a result, patients may experience trismus, dry socket, postoperative discomfort, and bony dehiscence. Furthermore, the small size of the labial bone or apical to free gingival margin may cause significant resorption during the socket's healing period, leading to postoperative pain and difficulties with prosthetic replacement. Additionally, even the quality of oral hygiene may decrease after nonsurgical tooth extraction [5]. Various devices and techniques are used for atraumatic tooth extraction, including driven peristomes, piezo surgery, lasers, orthodontic extrusion, and the Benex method. The Physics Forceps is a modern tool that uses biomechanical principles, including a first-class lever, creep, and tension delivery, for more predictable, faster, and less stressful extractions. The forceps were designed using biomechanics to make them more effective, especially in atraumatic cases [16]. A randomized controlled trial compared physics forceps with conventional forceps for removing 28 mandibular single rooted teeth, measuring crown/root/bone fractures, gingival tear incidence and extraction time. Samples were randomly assigned to control (conventional forceps) and

study (physics forceps) groups. They reported that in comparison to conventional forceps, physics forceps resulted in significantly faster extraction time (0.385 min. vs 3.971 min.) ($p=0.011$) and fewer incidents of buccal bone fracture (0.00% vs 28.57%), crown fracture (0.00% vs 21.43%), root fracture (3.57% vs 0.00%), and gingival tear (0.00% vs 50.00%), with the latter being highly significant ($p=0.006$). In these three studies, the mean time required for tooth extraction was evaluated. All of the studies found that using Physics forceps resulted in a significantly shorter operating time compared to conventional forceps. However, there was some variation in the way that the results were reported, with one study measuring the time in seconds and the other two studies measuring the time in minutes. Nonetheless, the consistency of the results across all three studies suggests that using Physics forceps can lead to faster and more efficient tooth extractions. The mean time required for tooth extraction was evaluated in previous four studies [17-19]. All the studies found that the use of Physics forceps resulted in a shorter operating time compared to conventional forceps. While one study reported the time taken in seconds, the other two studies reported the time taken in minutes [20]. Overall, these findings suggest that the application of Physics forceps can substantially decrease the duration of tooth extraction and improve efficiency. Another study by El-Kenawy and Ahmed compared the efficacy of physics forceps with conventional forceps for uncomplicated dental extractions, the percentage of crown fractures was 3% for the physics forceps group and 10% for the conventional forceps group. The percentage of buccal bone fractures was 3% for the physics forceps group and 7% for the conventional forceps group. The percentage of root fractures was 8.5% for the physics forceps group and 16.6% for the conventional forceps group [21]. Our study's findings regarding fewer soft tissue tears and less pain during tooth extraction with the Physics forceps compared to conventional forceps were supported by previous literature. Furthermore, these differences were found to be statistically significant [19, 20]. This indicates that the use of Physics forceps may result in improved patient outcomes and decreased discomfort during the extraction procedure.

CONCLUSIONS

It can be concluded that for first molar extraction, the use of physics forceps was superior to conventional forceps in terms of bone loss, soft tissue tear, time required for extraction, postoperative pain, and root fracture. These findings emphasize the potential advantages of incorporating physics forceps in dental procedures.

Authors Contribution

Conceptualization: SKP

Methodology: B, FI

Formal analysis: SAAZ

Writing-review and editing: FI, UQK, ZAM, SAAZ

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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