

ORIGINAL ARTICLE

Comparative Evaluation of Efficacy of Physics Forceps Versus Conventional Forceps in Orthodontic Extractions

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ABSTRACT

Objective: To comparative evaluation of efficacy of physics forceps versus conventional forceps in orthodontic extractions.

Design of the Study: It was a cross-sectional survey.

Place and Duration of Study: This study was carried at Department of Maxillofacial Surgery Mufti Mehmood Teaching Hospital Dera Ismail Khan from January 2022 to June 2022.

Patients and Methods: Total 300 healthy patients reporting to our department and who were indicated for removal of tooth with ideal extraction indications and conditions, and consenting for the same were taken up for the study. Patients were divided into 2 groups: Group-1 consisted of a split mouth study with 100 patients and Group-2 consisted of 200 patients consecutively selected and further categorised randomly, were subdivided into 2 subgroups, Group-2A (Conventional forceps group) and Group-2B (Physics forceps group) with 100 patients each. All the extraction procedures were done by 2 operators namely A and B & an experienced observing assistant was used for the assessment of Operative complications. Every patient underwent an adequate pre-surgical preparation consisting of adequate case history, gross scaling, blood test where indicated and radiographic examination.

Results of the Study: In Group-1 the average time taken with physics forceps was 33.14 seconds with a SD of 12.272 seconds and the average time taken with conventional forceps was 53.86 seconds with a SD of 24.985 seconds. In Group-2 the average time taken with physics forceps was 24.77 seconds with a SD of 9.878 seconds and the average time taken with conventional forceps was 34.78 seconds with a SD of 8.693 seconds. In Group-1 on 3rd post-operative day, with Conventional forceps the mean pain score was 6.45 and with Physics forceps the mean pain score was 4.15. In Group-2, on 3rd post-operative day, with Conventional forceps the mean pain score was 6.46 and with Physics forceps the mean pain score was 3.75.

Conclusion: Physics forceps are comparatively superior to conventional extraction forceps in terms of lesser time taken for the procedure, lesser tendency to induce trauma to both hard and soft tissue and have been found to induce comparatively lesser pain post extraction.

Keywords: Bone loss, Extraction forceps, Physics forceps, Soft tissue loss

INTRODUCTION

Dental extraction, also known as exodontia, refers to the removal of teeth from the oral cavity. Normal tooth extraction requires anchoring the tooth with forceps, expanding the alveolar bone, and then separating the periodontal attachment with elevators.^{1,2} An ideal tooth extraction is one in which the patient experiences no pain during or after the procedure, and where there is minimum stress to the surrounding tissues, allowing for a speedy and complete healing of the wound and no complications with the prosthesis.^{3,4} When a tooth needs to be pulled, the operator faces a difficult task. If the tooth's crown or root breaks, it can add stress to an already difficult extraction.⁵ Dentists perform atraumatic extractions because they are preferable for a number of reasons, including better extraction and postoperative wound healing, prevention of dry sockets, fracture of buccal cortical plate, gingival lacerations, too much bleeding, and maintenance of healthy bone for implant and denture placement, and preservation of natural tooth structure. Dento-alveolar housing trauma can lead to visible deformities in alveolar ridge and healing, impairing aesthetics and potentially preventing dental implant implantation or causing sub-pontic food trapping under conventional fixed partial dentures.^{6,7}

In recent years, "atraumatic" dental extraction methods have gained favour and may soon replace traditional methods as the gold standard for removing teeth. Bone and gingival architecture can be preserved by atraumatic extraction, opening the door to future or immediate dental implant insertion. Several methods and devices, including physics forceps, periotomes, powered periotomes, a piezosurgery system, and a benex extracto, have been proposed for the non-invasive extraction of teeth. Tooth extraction is more effective and causes less harm to the patient when controlled force and stability are used.⁸ In comparison to standard forceps and other extraction methods, physics forceps' are superior due to their design with a handle which allow them to

exert a considerable mechanical force. Instead of squeezing, the physicist's forceps are operated by rotating the wrist, which covers the buccal region of the beak with a plastic bumper that is placed apically in the vestibule. By rotating your wrist a small amount (approximately 3–4 degrees) and holding that position for 30–40 seconds, you can slowly extend the bone & periodontal ligament to relieve them. The moment the dentist feels the tooth loosen in the socket, he or she can take the forceps away and use another instrument to gently extract the tooth out of the socket.^{9,10}

Due to the problems appearing in tooth extraction by usual instruments and methods, there was a need to evaluate the present forceps and extraction techniques in order to improve the working efficacy and simplify surgical procedures. However, we know of no clinical studies that have compared the use of the Physics forceps with the universal extraction forceps. Hence this study is to evaluate and compare the efficacy of a conventional forceps versus physics forceps.

PATIENTS AND METHODS

Study Setting & Study Duration: This study was carried at Department of Maxillofacial Surgery Mufti Mehmood Teaching Hospital Dera Ismail Khan from January 2022 to June 2022

Study Design: randomized controlled trial

Inclusion Criteria: Patients having ages between 14 to 60 yrs recommended for extraction of both mandibular and maxillary bilateral teeth were included in this study. Patients presented with severely decayed tooth / Root remnants with a minimum of 3mm tooth structure above the gingival margin with 1/4th surface intact, root canal treatment failure tooth.

Exclusion Criteria: Any tooth which is ankylosed or has a hypercementosis root. Tooth associated with periodontitis / periapical pathology. Any subject who is contraindicated for radiograph. Patients with oro-facial cancer or under chemotherapy

or head and neck radiotherapy. All condition which are contraindicated for tooth extraction. Primary tooth, incisors, 3rd molar and teeth with greater than grade 1 mobility. Root stumps with soft caries at the coronal third.

Methodology: A total of 300 patients who reported to the department of Oral and Maxillofacial Surgery, requiring bilateral therapeutic extractions of premolars in maxillary or mandibular arch or both arches for orthodontic treatment purpose and consenting for the study were included in the study. The study protocol was reviewed and approved by an Institutional review board. Patients were divided into 2 groups Group-1 and Group-2 with 100 subjects and 200 subjects respectively. Every patient underwent an adequate pre-surgical preparation consisting of adequate case history, gross scaling, blood test where indicated and radiographic examination.

Group-1: consisted of a split mouth study with 100 patients who had been referred for alike tooth upper / lower arch extraction bilaterally for orthodontic and prosthetic reasons which were performed by Conventional forceps on one side and with Physics forceps on another side by a single Operator.

Group-2: consisted of 200 patients consecutively selected from within the inclusion criteria and further categorised randomly, were subdivided into 2 subgroups, Group-2A (Conventional forceps group) and Group-2B (Physics forceps group) with 100 patients each.

Following the standard surgical protocol in all cases, 2% lignocaine hydrochloride with 1:80,000 adrenalin solution was used to provide adequate anesthesia. Local infiltration, infraorbital nerve block, nasopalatine nerve block, greater palatine nerve block, posterior superior alveolar nerve block or inferior alveolar nerve blocks were used depending upon the anatomic distribution of the teeth to be extracted.

Prior to extraction, IOPAR (intraoral periapical radiograph) using paralleling technique along with gridlines of tooth to be extracted were taken and pre extraction bone level were measured using gridlines at mesial, middle and distal third region on the buccal side of tooth and values were recorded. First and fourth quadrant premolars using physics forceps (group A) and second and third quadrant premolars using conventional forceps (group B) were planned to be extracted. Elevators were not be used for luxation.

Following extraction by both forceps, similarly post extraction gingival level (POG) was determined. The difference of mean value of pre and post extraction gingival level suggested the gingiva loss. The difference of mean value of pre and post extraction bone level was calculated similarly which suggested the bone loss. Post extraction, dressing and instructions were given and medications were prescribed. At the time of follow-up 1 month post-extraction, difference of mean value of present and post extraction bone level were calculated similarly which indicated bone loss.

Categorical and quantitative variables were expressed as frequency (percentage) and mean ± SD respectively. An independent t-test was used to compare quantitative parameters between categories. The Chi-square test and Fisher's exact test were used to find an association between categorical variables. Mann-Whitney U-test was used to compare ordinal parameters between groups. For all statistical interpretations, p<0.05 was considered the threshold for statistical significance. Statistical analysis was performed by using a statistical software package SPSS, version 20.0

STUDY RESULTS

The study comprised of 300 patients (194 male and 106 female) in the age group of 14-60 years. Among them, Group-1 ie. Split mouth study group consisted of 100 patients (62 male and 38 female patients); and Group-2 ie. Random mouth study group consisted of 200 patients (132 males and 68 females). The type of tooth included in the study for extraction was indicated for orthodontics purpose, prosthetic purpose, previously root canal

treated tooth and severely decayed tooth / root remnants with a minimum of 3mm tooth structure above the gingival margin. A total of 208 orthodontic tooth extractions, 103 tooth extractions for prosthetic purpose, 28 Root canal treated teeth, and 61 severely decayed tooth / root remnants with a minimum of 3mm tooth structure above the gingival margin were carried out. The mean age in the Group-1 (Split mouth study group) was 27.78 years; and 35.88 years in Group 2. When each group was evaluated, the following results were obtained.

Table 1:

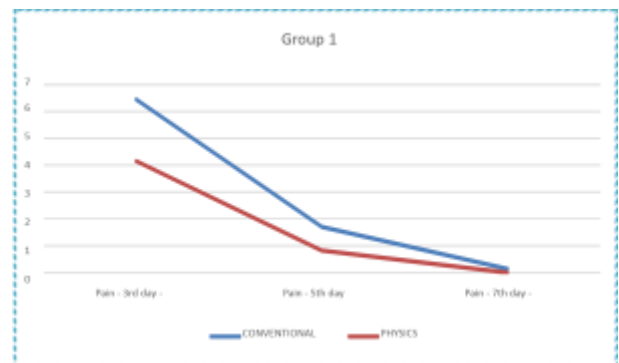
Outcome	Parameters	Group	Mean±SD	P-Value
Time	Group-I	Conventional Forceps time (secs)	53.86±24.98	0.001
		Physics Forceps time (secs)	33.14±12.27	
	Group-II	Conventional Forceps time (secs)	34.78±8.693	
		Physics Forceps time (secs)	24.77±9.878	

Table 2: Intraoperative Evaluation

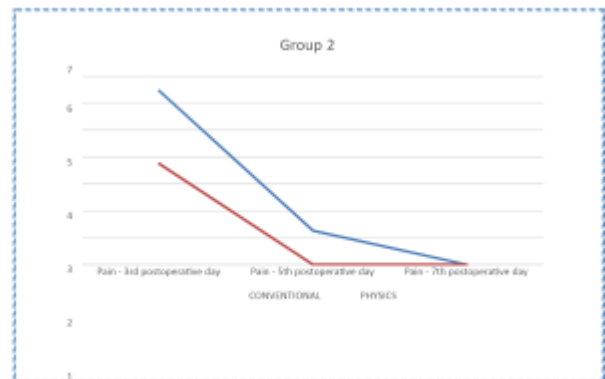
	Conventional forceps	Physics forceps
Root fracture	17	3
Bone plate fracture with attached periostium	3	1
Adherent of buccal plate to root	5	0

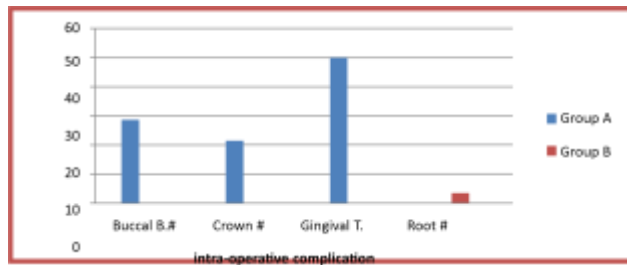
Table 3: Success of extraction

	Complete success	Limited success with root fracture	Limited success with osteotomy	Failure to extract
Conventional forceps	183	17	0	0
Physics forceps	197	3	0	0



Graph 1: Group-1 Comparison of Pain using VAS on post-operative day 3, 5 and 7.





Graph 2: Group-3 Comparison of Pain using VAS on post-operative day 3, 5 and 7

DISCUSSION

It had been long since the traditional methods of extraction have been used to atraumatically loosen and dislodge the tooth without damaging the alveolar bone or supporting tissue. Traditional methods of extraction often result in damage ranging from mild gingival tissue laceration to complete loss of the buccal bony plate and interdental bone crest. Some of the other complications involves trismus, dry socket, post-operative pain and if a bony dehiscence exists apical to free gingival margin, or the labial bone is very thin, it may undergo significant resorption during natural healing process of socket.^{11,12}

This study aimed to compare the efficacy between Physics and Conventional extraction forceps in relation to operative time, postoperative pain, healing of extraction socket, presence / absence of erythema, fracture of the crown, roots, and alveolar bone plates.

In the current study, the operating time was calculated to compare the efficacy of the physics forceps with the conventional forceps, and statistical analysis showed that there was a significant difference between the two extraction procedure timing. Operating time was calculated from the point of application of the beaks on the tooth to the delivery of tooth. The average time that was taken for the tooth extraction with Conventional forceps was approximately 53.86 secs in Group-1 and 34.78 secs in Group-2, while the Physics forceps took approximately 33.14 secs in Group-1 and 24.77 secs in Group-2. The mean duration of extraction procedure was longer with the Conventional forceps than with the Physics forceps. T. Lally et al.¹³ also compared the extraction time for both the forceps and found that the Conventional forceps had a mean extraction time of 188.55 secs and Physics forceps a mean time of 120.45 secs. In another study done by Samyuktha et al.¹⁴, the mean operating time using the Conventional extraction forceps was 43.5(49.5) secs and with Physics forceps was 29.4 (27.3) secs. This shows that the operating time was slightly more with the use of Conventional forceps which is consistent with the literature. The reason for the lesser time required in physics forceps extraction can be attributed to the biomechanical advantages of a first-class lever with a controlled force eliminating the need for the third force (clinician's arm) unlike the Conventional forceps.

Clinical evaluation of both the forceps was done to compare its efficacy during extraction. An observing assistant assessed for the intraoperative complications such as root fracture, bone plate fracture or any adherent of buccal plate to the root. A simple yes/no format was used for the assessment. It was found that in 17 (8.5 %) cases root fractured with the use of Conventional extraction forceps while only 3 (1.5%) cases were noted with that of Physics forceps. Bone plate fracture with intact periosteum was seen in 3 (1.5 %) cases of conventional forceps while with physics forceps only 1(0.5%) case of bone plate fracture was noted. In 5 (2.5 %) cases performed with conventional forceps there was an adherence of buccal plate to the root. In a study conducted by Mohamed H. El-Kenawy et al.¹⁵, it was noted that roots fracture occurred in 8.5 % with Physics forceps and in 16.6% with Conventional forceps. These results were concomitant with the study of Misch and Perez.¹⁶, who concluded that the handles of conventional forceps allow the operator to grasp the tooth but do

not assist in the mechanical advantage to remove it. This is similar to attempting to pull a bottle cap off a bottle using a pair of pliers versus using the advantages of a lever to remove the cap, as with standard bottle cap opener. The extraction of a tooth using physics forceps is similar to the removal of a nail from wood using a hammer versus a pair of pliers. The handle of the hammer is a lever, and the beak of the hammer's claw fit under the head of a nail. The hammer's head acts as a fulcrum. A rotational force applied to the hammer's handle is magnified by the length of the hammer's handle, which elevates the nail out of the wood. The physics forceps applies a constant and steady pressure with the wrist only, as this technique requires a minimal amount of strength and a maximum amount of patience, that helping to decrease the incidence of buccal bone fracture. The bumper applies a compressive force at the buccal bone as it was positioned on the buccal alveolar ridge, resulting in holding and supporting the bone in its place. This result was in agreement with the result of Kosinski et al.¹⁷ who stated that the buccal movement applied by physics forceps was slow and generally insufficient to fracture the buccal bone plate.

To judge the success of extraction a criteria was followed and it was noted that using conventional forceps the success rate of extraction is comparatively less at 91.5% to that of physics forceps at 98.5%. Fracture of root was observed in 17 extraction cases performed with conventional forceps and in 3 cases in which physics forceps was used. Mohamed H. El-Kenawy et al.¹⁵ noted 91.5% success of extraction using Physics forceps while 83.4% success of extraction was seen using Conventional forceps.

The VAS for pain on postoperative day 7, in Group-1 with Conventional forceps was 0.14(0.349) and in Group-2 it was similar with both the forceps as all patients scored 0 on each occasion. Post-operative pain was significantly lesser with the use of physics forceps than the conventional forceps from day 1 to 7 which was proven statistically by paired - t test. Soumen et al.¹⁸ compared post-operative pain on the basis of Facial Pain Scale Revised (F.P.S) between test group (Physics forceps) and the control group (Conventional forceps) for multirooted tooth. According to Dymand Weiss,^{19,20} there is no need to raise a mucoperiosteal flap or use an elevator before attempting extraction with the Physics forceps.

CONCLUSION

We are of the opinion that physics forceps can be used as a helpful aid in atraumatic extraction of mandibular tooth, it not only reduces patient's post-operative discomfort but also maintain the socket integrity by not disturbing the soft tissue and hard tissue architecture and thus making future prosthesis replacement easier

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