Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

ORIGINAL RESEARCH

Physics forceps for orthodontic extraction of upper premolars: A newer trend

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Article History: **Received:** 19.06.2023 **Revised:** 12.07.2023 **Accepted:** 29.07. 2023

Abstract:

Introduction: Extraction of teeth is one of the oldest procedures practiced since beginning of civilisation. Various instruments have been developed for tooth extraction over centuries to make it as atraumatic as possible for future prosthetic rehabilitation. Over the last few years, number of tools and techniques e.g, periotome, physics forceps, benexextractor, etc has been developed for minimally invasive tooth removal. . Study aimed at comparing the efficacy of physics forceps with conventional forceps in orthodontic extraction of upper premolars was done. **Material and Method**: 50 patients of both genders requiring orthodontic tooth extraction of upper premolars were randomly divided into two groups-Group I (25 patients)-extraction carried out with conventional forcep & Group II (25 patients)-extraction carried out with physics forceps. **Results:** In the present study, parameters showed physics forcep has higher success rate in terms of tooth/buccal plate fracture, requires less intra-operative time for extraction of premolars. Moreover postoperative pain associated with extraction using physics forceps was less when compared to conventional forceps. **Conclusion:** Present study reveals that physics forcep is a safe, reliable and efficient tool for orthodontic extraction of maxillary premolars as compared to conventional forceps in terms of tooth/buccal plate fracture, post-extraction bleeding, post-extraction pain & gingival laceration.

Introduction

Extraction of toothis ideally a minimally traumatic procedure, however certain degree of trauma to investing tissues e.g., gingiva & alveolar bone is inevitable. Over the past years, increasing demand for preservation of adjacent tissues has led to development of tools for atraumatic extraction for subsequent prosthetic rehabilitation[6]. A number of tools and techniques have been proposed for minimally invasive tooth removal such as physics forceps, powertome, proximators, periotomes and benex extractor. Physics forceps are the most innovative oral surgery instruments in recent years, completely changing the physics behind dental extractions; hence it is named as physics forceps. They were developed by Dr. Richard Golden in 2004 and have been modified with the help of several doctors. The main advantage of physics forceps over conventional forceps is related to their unique design that can deliver

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a powerful mechanical advantage by employing an efficient first-class lever.[7] this study was designed to compare the efficacy of physics forcep versus conventional forcep in simple dental extractions.

Aims & Objectives: To compare the efficacy of physics forceps with conventional forceps, in orthodontic extraction of upper premolars under the following parameters- time taken for extraction, success score of extraction based on Choi et al scoring, post-extraction pain, bleeding & gingival laceration.

Material and Method: 50 patients were included in this prospective study who reported for oral treatment to the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Srinagar during January 2018 to October 2020, requiring orthodontic dental extraction of upper premolars after taking clearance from institutional ethical committee. Patients above 13 years of age were selected. Patients were selected irrespective of sex, cast, and religion and socio economic status after taking informed consent, according to following inclusion and exclusion criteria:

Inclusion criteria:

- Healthy subjects of both the genders above 13 years of age.
- Patients with no general medical contraindication for dental extraction.
- Patients requiring orthodontic extraction of upper premolars.

Exclusion criterias:

- Patients with teeth having abnormal root morphology (as dilacerated, severely curved, bulbous roots, ankylosed etc.) as depicted by preoperative periapical x ray examination.
- Patients with uncontrolled systemic disease.

Material to be used:

- Diagnostic instruments.
- 2 ml syringe with 25 G short needle.
- 2% lignocaine HCl with adrenaline 1:80,000.
- Physics forceps.
- Standard exodontia armamentarium for extraction.
- Stop Watch.

Patient grouping

The selected patients were randomly allocated into two groups:

Group-I (Conventional forceps group): 25 patients were included in this group and dental extractions were carried out by using conventional forceps.

Group-II (Physics forceps group): 25 patients were included in this group
and all dental extractions were carried out by using physics forceps.

Split mouth extractions were carried out in cases where bilateral extractions needed. In such situation, a gap period of one week was kept between two extractions.

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Surgical procedure

All extractions were done by the same operator following standard aseptic surgical procedure. Local anesthesia was induced using 2% lignocaine hydrochloride with 1:80000 adrenaline using 26 gauge needle disposable syringe (DISPOVAN).

Extraction using conventional forceps was done in the following sequence:

1. Gingival attachment was separated from the tooth using mucoperiosteal elevator.
2. Elevators were not used for luxation of tooth to be extracted
3. Tooth specific forceps were used for extraction of particular tooth.
4. The beaks of forceps were placed at the cervical portion of the tooth and positioned as apically as possible.
5. Extraction was carried out using tooth specific movements.

Extraction using physics forcep was done in the following sequence:

1. Palatal gingival attachment was separated from the tooth using mucoperiosteal elevator.
2. Elevators were not used for luxation of tooth to be extracted.
3. The beak of the forcep was placed on the palatal aspect of the tooth at or below cement-enamel junction.
4. The bumper (which is covered by plastic or rubber to avoid trauma to the buccal soft tissue) was placed on the buccal alveolar bone at mucogingival junction.
5. A steady and gentle rotational force was applied to the tooth in a buccal direction using 'wrist movement only' without squeezing the handles.
6. Once the tooth was loosened, it was removed with traditional instruments such as a conventional forceps or a rongeur.

The sockets were compressed manually and betadine soaked gauze was placed over the socket, and patient was asked to bite on it for 30 minutes. Same post-operative instructions were given to all patients.

All patients were prescribed following medications:
• Cap. Amoxicillin & Clavulanic acid 625 mg 12 hourly for 3 days
• Tab. Diclofenec Sodium 50 mg 12 hourly for 3 days
• Tab. Pantoprazole 40 mg once daily for 3days.

INTRAOPERATIVE PICTURE

FORCEP APPLICATION

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POPPING OF TOOTH

POST EXTRACTION SOCKET

Results:

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 29.0(SPSS Inc., Chicago, Illinois, USA) and R software. Continuous variables were expressed as Mean ±SD and categorical variables were summarised as frequencies and percentages. Student's independent t- test was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A P-value of less than 0.05 was considered statistically significant.

Out of a total 50 patients included in this study, 36 (72%) were in the range of 15 – 24 years of age and 13(26%) were of 25-34 years of age and 1(2%) was 35 year of age . The mean age of the subjects in Group I was 20.84 ± 5.52, while as in Group II the mean age was 21.36± 5.95. Statistically no significant difference was seen between the two groups (P = 0.584).

Primary variables

Pre-Operative Assessment

Teeth conditions

Teeth conditions were determined from clinical and radiographic findings.

Intra-Operative Assessment

Extraction Time

Extraction time was less than a minute (min.) in 16 cases of Group I and 20 cases of Group II. The mean time taken for extraction in Group I patients was 145.6 seconds (sec.) and in Group II was 85.4 seconds (sec). Statistically significant difference was seen between the two groups (P = 0.002) **[Table 1]**.

Table 1: Comparison based on operating time (seconds) between two groups

Operating time (Seconds)	N	Mean	SD	Range	t-value	P-value
Group I	25	51.04	10.216	37-70	3.219	0.002*

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Group II	25	42.06	8.215	28-59		

Statistically Significant Difference (P-value<0.05)

Success score of extraction

Complete success was achieved in 22(88%) cases of Group I and 24 (96%) cases of Group II. Poor result (root fracture) was found in 3 (12%) cases of Group I compared to 1 (4%) case of Group II. **[Table 2]** Mean success score of extraction in Group I was 4.01 and in Group II was 4.52. There was no statistically significant difference in mean success score (P = 0.397) between the two groups.

Table 2: Comparison based on success score of extraction between two groups

Success Score	Group I		Group II		P-value
	No.	%age	No.	%age	
Score 1	-	-	-	-	0.397
Score 2	-	-	-	-	
Score 3	2	8	1	4	
Score 4	1	4	-	-	
Score 5	22	88	24	96	
Total	25	100	25	100	
Mean± SD	4.80±0.57		4.92±0.40		

Buccal cortical plate fracture

Buccal cortical plate fracture was found in 17 cases (68%) of Group I and 8 cases (30%) of Group II. There was a significant difference between the two groups (P = 0.001) **[Table 3].**

Table 3: Comparison based on buccal cortical plate fracture between two groups

Buccal cortical plate fracture	Group I		Group II		P-value
	No.	%age	No.	%age	
Yes	16	64%	9	36%	0.048*
No	9	36%	16	64%	
Total	25	100	25	100	

Statistically Significant Difference (P-value<0.05)

Secondary variables

Post-operative assessment

PAIN

Pain score was measured on VAS scale and was recorded on 3rd and 7th post-operative days. Mean VAS score on 3rd post-op. day in Group I and Group II patients was 0.96 and 0.76

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respectively while on 7th post-op. day the scores were 0.40 and 0.41 respectively. Group II had significantly less pain on the 3rd postoperative day than the other group (P = 0.471) **[Table 4]**. However, the VAS for pain on 7th post-operative day was not different between 2 groups (P = 0.990)

Table 4: Comparison based on pain score on 3rd and 7th day between two groups

Pain Score	Group I		Group II		P-value
	Mean	SD	Mean	SD	
3rd Day	0.96	0.84	0.76	1.09	0.471
7th Day	0.40	0.50	0.41	0.50	0.990

Gingival laceration

Gingival laceration was reported at the time of extraction, out of 25 teeth extracted using conventional forceps 15(59.5%) suffered gingival laceration while as only 8(31.9%) out of 25 teeth suffered laceration using physics forceps **[Table 5].** There was statistically significant difference (P value=0.007) between the two groups].

Table 5: Comparison based on gingival laceration between two groups

Gingival laceration	Group I		Group II		P-value
	No.	%age	No.	%age	
Yes	15	60.0	8	32.0	0.047*
No	10	40.0	17	68.0	
Total	25	100	25	100	

Statistically Significant Difference (P-value<0.05)

Bleeding

Bleeding was noted in patients following extraction using both forceps. In Group I - 7 out of 25(28%) patients experienced minimal bleed, 9(36%) moderate and 9(36%) suffered continuous bleed whereas 11 out of 25(44%) patients experienced minimal bleed, 8 (32%) moderate and 6(24%) suffered continuous low bleeding in Group II**(Table 6).**

Table 6: Showing bleeding between two groups

Bleeding	Group I		Group II		P-value
	No.	%age	No.	%age	

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Minimal	7	28.0	11	44.0	0.461
Moderate	9	36.0	8	32.0	
Continuous low bleeding	9	36.0	6	24.0	
Total	25	100	25	100	

Discussion:

Increased interest for atraumatic tooth extraction in order to maintain alveolar bone for implant insertion has developed. Various instruments for such purpose have been developed which include physics forceps, benex extraction system, periotome, piezosurgery etc.[(4)] The physics forceps have been hailedas the most thrilling and ground-breaking progress in tooth extractions in over 200 years[10]. Implementation of a first class lever, creep and the type of force provides the mechanical advantages necessary to make this extraction device more efficient [11]. It is used by rotation of the wrist rather than a squeezing, buccal-lingual luxating and twisting movement of conventional forceps. The handles are rotated steadily as a single unit for a few degrees creating a greater release of hyaluronidase than traditional forceps and elevators because trauma from those techniques is intermittent. The force applied by the bumper on the gingiva and bone is over large surface area and is a compressive force, so the tooth and alveolus do not fracture. [(1)]

Conventional dental forceps are two first-class levers that are connected with hinge. Forces are applied on the long side of the lever i.e. the handles, the beaks act as the load arm of the lever, hinge act as fulcrum and tooth to be extracted act as load. Hence the force applied on the handle is magnified to allow the forceps to grasp the tooth and does not provide mechanical advantage to extract the tooth. This makes physics forceps more efficient, and causes less tooth and alveolus fracture.[6,7,9]

In the present study, we evaluated & compared the efficacy of physics forceps (Group II patients) with conventional forceps (Group I patients) in terms of extraction time, success score of extraction, post-extraction pain, bleeding & gingival laceration. In our study, time required to extract teeth using physics forceps was lesser compared to that of conventional forceps and the overall difference (mean time of extraction for physics forceps was 42.06 seconds while that for conventional was 51.04 seconds) was statistically significant.

Mean success scores of extraction using physics forceps was 4.92 and using conventional forceps was 4.80. There was no statistically significant difference in mean success score (P = 0.397) between the two groups. However, poor result (root tip fracture) was found in 2 (8%) teeth extracted using conventional forceps compared to 1 (4%) case of physics group and one tooth suffered complete root fracture in case of conventional forcep. The results were concomitant with the study conducted by Mohamad H. El-Kenawy and Wael Mohamed Said Ahmed [3)]

In our study, buccal cortical plate fracture was found in 9 cases of physics forcep group & 16 cases in conventional forceps group. The difference was statistically significant which is in agreement with the result of Harsh Patel et al [1].

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In our study, 15 out of 25 teeth (60%) extracted using conventional forceps suffered gingival laceration whereas 8 out of 25 (32%) patients suffered gingival laceration following extraction using physics forceps. The difference was statistically significant (P value = 0.047) which is in accordance with the study conducted by Harsh S. Patel et al [1]

In the present study, significant difference between the groups was reported in pain on the third postoperative day. The results are at par with the conclusions of S Hariharan et al [8]. Who found significantly lesser postoperative pain in physics forceps group on first postoperative day when compared to conventional forceps.

Post-extraction bleeding in physics forcep group patients was less as compared to the patients in which extraction was performed using conventional forceps, however the difference was statistically insignificant (p-value=0.461).

Limitations of the study:

- Only premolars were included in the study.
- Less sample size was selected.

Conclusion:

From the present study it can be concluded that the physics forceps can be considered as a reliable, less invasive and less traumatic tooth extraction technique with higher clinical success in terms of tooth/ buccal plate fracture which is critical for orthodontic extractions.

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