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Original Research Article

Comparison of physics forceps to conventional forceps in simple dental extraction

Shanender Singh Sambyal[1]*, Vivek Saxena[2], V. Gopalkrishnan[2], Rangarajan H.[2], Andrews Navin Kumar[3]

[1]Medical College, Trivandrum, Kerala, India
[2]Army Dental College (R&R), New Delhi, India
[3]Dental Unit, Leh, Ladakh, India

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***Correspondence:**
Dr. Shanender Singh Sambyal,
E-mail: navin.andrews@gmail.com

ABSTRACT

Background: In this study, Conventional forceps & Physics forceps were compared in simple dental extractions with respect to crown and root fracture of tooth during extraction, alveolar bone plate fracture, gingival laceration, requirement of sutures, duration of surgery, comparative pain evaluation through visual analogue scale and analgesic requirement in the first 24 hours post operatively.
Methods: This study was conducted at our centre where 200 patients requiring simple dental extractions were randomly divided into two groups, each having 100 patients. Extractions in one group were done using Conventional forceps and in other group were done using Physics forceps. All parameters were measured during surgery & questionnaires were given to all the patients to assess the pain perception & analgesic requirement postoperatively till 24 hours.
Results: The results of present study showed decreased incidence of crown and root fracture of tooth, alveolar bone plate fracture, gingival lacerations, requirement of sutures, lesser duration for extraction and lesser pain perception in Physics forceps group. No significant difference was found between two groups for analgesic intake.
Conclusions: Physics forceps group patients had superior results compared to patients in Conventional forceps group which may be attributed to lesser hard and soft tissue injuries and better pain control in Physics forceps group.

Key Words: Conventional forceps, Physics forceps, Pain, Dental extractions

INTRODUCTION

The specialty of oral and maxillofacial surgery has evolved in the past few decades having such diverse fields of craniofacial surgery, microvascular reconstruction etc, however the most commonly performed procedure by maxillofacial surgeons in many countries remains to be exodontia which includes non-surgical routine tooth extractions as well as impacted tooth removal.[1] Teeth are extracted for many reasons, which incudes grossly carious tooth, severe periodontal disease, orthodontic extractions, malposed teeth, cracked teeth, preprosthetic extractions, impacted teeth, supernumerary teeth, teeth associated with pathologic lesions, preradiation therapy, teeth in the line of jaw fractures, esthetics, and economics.[2] The ultimate goal of traditional extraction techniques is removal of the tooth from its dentoalveolar housing with minimum damage to investing tissues. Traumatic damage to the dentoalveolar socket during extraction can result in deficient bony ridges upon healing which can prohibit dental implant placement or lead to food entrapment beneath pontic in traditional fixed partial dentures.[3]

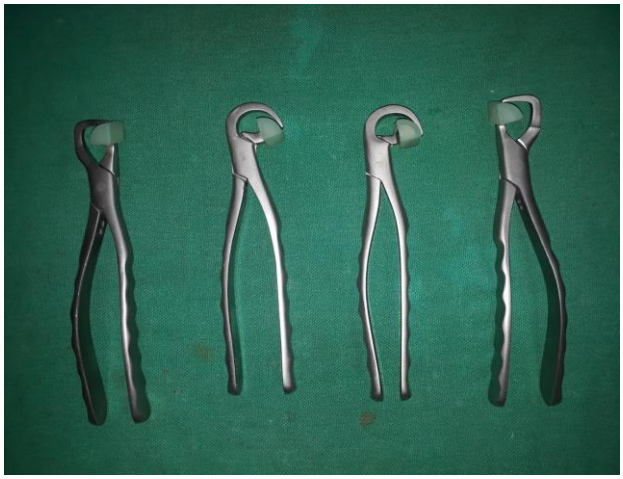

Figure 1: Physics forceps (starting from left upper right posterior, upper anterior, lower universal, upper left posterior).

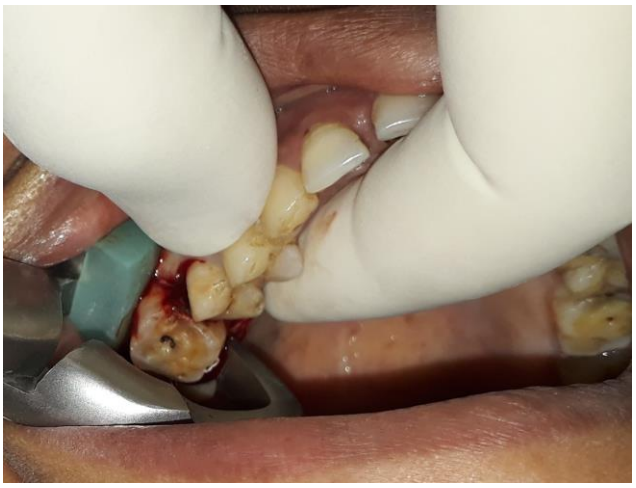

Figure 2: Intra-operative application of physics forceps and loosened out tooth with rotatory movements.

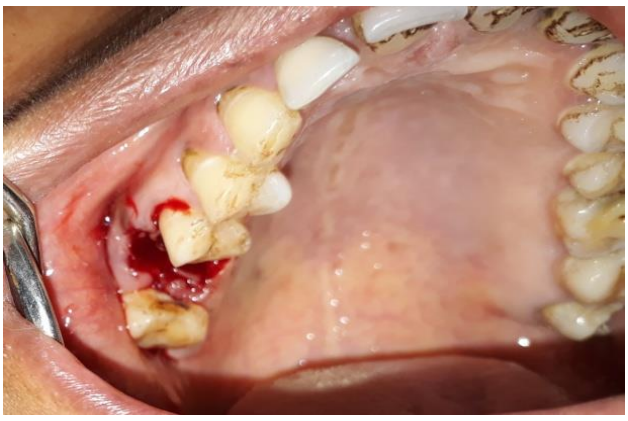

Figure 3: Extracted tooth with Physics forceps causing minimum trauma to extraction site.

Atraumatic dental extraction preserves bone, gingival architecture, and allows for the option of future or immediate dental implant placement. A number of tools and techniques have been proposed for minimally invasive tooth removal such as physics forceps, powertome, proximators, periotomes and benex extractor.[4] Physics forceps (Figure 1) were designed by Golden et al it enables to predictably remove even the most grossly broken down teeth with little or no trauma to the surgical site. The biomechanical design of this instrument decreases the incidence of root fracture, and maintains the buccal bone plate, which is essential for the proper healing of an immediately placed dental implant.[5] Considering all methods, a comparative study was planned to compare the Physics forceps and conventional forceps method for simple dental extraction by comparing intra-operative complications, duration of extractions & post-operative complications.

METHODS

A total of 200 patients who required dental extraction were included in this prospective randomized clinical study at a tertiary care Military Dental Centre, Lucknow from May 2017 to July 2018. A clearance for the study was obtained from the Institutional ethical committee which comprised the members of the institution and Station Health Officer, and each patient was given a brief description of the intended procedure with follow up period and was required to sign an informed consent sheet. Patients having age more than 18 years requiring nonsurgical removal of single tooth either maxillary or mandibular (single/ multirooted)/grossly decayed tooth/fractured tooth/root canal treated tooth were included in the study. Patients with teeth having abnormal root morphology (as dilacerated, severely curved, bulbous roots, etc.) as depicted by preoperative radiographic examination, impacted teeth/malposed teeth/periodontally compromised teeth having Grade II or Grade III mobility were excluded from the study. Medically compromised patients or patients already taking analgesics which interferes with pain response were excluded from study. The selected patients were randomly allocated into two groups of 100 each: Group I (Physics forceps group) & Group II (Conventional forceps group). Pre-treatment radiographic evaluation was carried out with radiovisio-graph and panoramic radiograph. Local anesthesia was achieved with 2% lignocaine HCL with 1:80,000 adrenaline. Extractions in group I patients were done using Physics forceps as described below (Figure 2-3). Mucoperiosteal elevator (Molt No. 9) was used for separation of gingival attachment. Forceps beak was placed into the depth of the lingual or palatal sulcus and a secure purchase point on intact root surface of the tooth was made. The bumper (which is covered by rubber to avoid trauma to the buccal soft tissues) was set perpendicular to the tooth at or above the level of the mucogingival junction. A steady and slow rotational force was applied in the direction of the bumper without squeezing the handles or moving the arm. As the periodontal ligament disengages, the tooth pops out which was easily delivered with a conventional instrument.

Extractions in group II patients were done using conventional forceps.

Intra-operative data collection

Data was recorded on case report forms including age, gender and tooth type with following parameters in both the groups. Crown fracture (Yes/No), Root fracture (Yes/No), Bone plate fracture (Yes/No), Gingival tissue laceration (Yes/No), Requirement of sutures (Yes/No), Total time taken for extraction (after securing anesthesia till the placement of hemostatic gauze piece after extraction)

Post-operative data collection

Patients were asked to record number of analgesics taken for 24 hours post operatively at interval of 2 hours, 4 hours, 8 hours, 12 hours & 24 hours on the questionnaires. The patients were also instructed to assess and record their subjective postoperative pain intensity on visual analogue scale (VAS) having horizontal line running from 'no pain' (0 mm) to 'worst pain' (100 mm). No patients were prescribed antibiotics and were instructed to take painkillers as and when required. Relationship between various parameters were analyzed by Chi-square test, student's unpaired 't' test, Mann Whitney 'U' test.

RESULTS

Age and sex

The study included total 200 patients (96 females and 104 males) in which 50 females and 50 males were in the Group I (physics forceps) with mean age 45.59±12.53 and range between 18-69 years. In Group II (conventional forceps) 46 males and 54 females were there with mean age of 44.95±14.18 with range between 18-72 years. Hence the age difference in both the groups was not statistically significant (Table 1).

Table 1: Demographic details.

Parameters		Group		Total	P value
		Conventional	Physics		
Sex	Male	54	50	104	0.792
	Female	46	50	96	
Total		100	100	200	

Crown and root fracture

In Group I (physics forceps) 14 patients (14 %) had crown fracture and 10 (10%) patients had root fracture. In Group II (conventional forceps) 26 patients (26%) had crown fracture and 14 patients (14 %) had root fracture. The difference of crown and root fracture in both the groups is not statistically significant (p value=0.051 & 0.515 respectively) but clinically significant difference of lesser crown fracture is seen in Group I (Table 2-3).

Table 2: Crown fracture.

Crown fracture	Group		Total	P value
	Conventional	Physics		
Yes	26	14	40	0.051
No	74	86	160	
Total	100	100	200	

Table 3: Root fracture.

Root fracture	Group		Total	P value
	Conventional	Physics		
Yes	14	10	24	0.515
No	86	90	176	
Total	100	100	200	

Alveolar bone plate fracture

12 patients (12%) in Group I (physics forceps) had alveolar bone plate fracture compared to 25 patients (25 %) in Group II (conventional forceps) which is statistically (p value 0.028) and clinically significant difference (Table 4).

Table 4: Alveolar bone plate fracture.

Alveolar bone fracture	Group		Total	P value
	Conventional	Physics		
Yes	25	12	37	0.028
No	75	88	163	
Total	100	100	200	

Gingival laceration

Total 14 patients (14%) had gingival laceration in Group I (physics forceps) compared to 20 patients (20%) in Group II (conventional forceps) which is not statistically significant (p value 0.347) (Table 5).

Table 5: Gingival laceration.

Gingival laceration	Group		Total	P value
	Conventional	Physics		
Yes	20	14	34	0.347
No	80	86	166	
Total	100	100	200	

Requirement of sutures

Post extraction suturing was required in 9 patients (9%) in Group I (physics forceps) compared to 24 patients (24%) in Group II (conventional forceps) which is statistically (p value 0.008) and clinically highly significant (Table 6).

Duration for extraction procedure after achieving anesthesia

The total time taken for extraction procedure after achieving anesthesia in Group I (physics forceps) was in

the range of 3-10 minutes with mean time of 4.67±1.16 minutes compared to Group II (conventional forceps) with the range of 3-15 minutes with mean time of 5.47±1.59 minutes which is statistically (p<0.001) and clinically significant difference.

Table 6: Requirement of sutures.

Requirement of sutures	Group		Total	P value
	Conventional	Physics		
Yes	24	9	33	0.008
No	76	91	167	
Total	100	100	200	

Table 7: Analgesic requirements.

Analgesic requirements	Group		Total	P value
	Conventional	Physics		
Yes	83	84	167	0.999
No	17	16	33	
Total	100	100	200	

Postoperative pain assessment: (VAS scores)

At the 2nd postoperative hour the mean value of pain score was 1.21±1.79 & 1.54±1.87 for Group I (physics forceps) & Group II (conventional forceps) respectively with the mean difference of 0.33 which is statistically insignificant difference (p value =0.077). At the 4th postoperative hour the mean value of pain score was 2.98±2.41 & 3.80±2.12 for Group I (physics forceps) & Group II (conventional forceps) respectively with the mean difference of 0.82 which is statistically significant difference (p=0.007).

At 8th postoperative hour the mean value of pain score was 3.35±2.02 for Group I (physics forceps) & 4.06±2.12 for Group II (conventional forceps) with the mean difference of 0.71 which is statistically significant (p=0.007). At 12th postoperative hour the mean value of pain score was 2.87±2.12 & 2.99±1.83 for Group I (physics forceps) & Group II (conventional forceps) respectively having mean difference of 0.12 which is statistically insignificant difference between these two groups (p=0.862). At 24th postoperative hour the mean value of pain score was 2.36±2.08 & 2.29±2.07 Group I (physics forceps) & Group II (conventional forceps) respectively having mean difference of 0.07 which is statistically not significant difference between these two groups (p=0.862).

Analgesics taken postoperatively

The mean number of analgesics for Group I (physics forceps) was found to be 1.71±1.04 tablets as compared to 1.62±0.98 tablets for Group II (conventional forceps) with the mean difference of 0.09 tablets which is statistically insignificant (p=0.53). In Group I, 17 patients did not take any analgesics post-operatively while in Group II, 16 patients did not take any analgesics post-operatively which is statistically and clinically insignificant (Table 7).

DISCUSSION

In our study physics forceps group had lesser incidence of crown and root fracture compared to conventional forceps group. This is in accordance with Choi et al study who extracted 96 premolars and molars for intentional replantation using physics forceps and found complete success rate (no crown and root fracture) in 93% cases, the limited success rates because of partial root tip fracture and partial osteotomy to be 2% and 5% respectively.[6]

Oue study results showed lesser incidence of alveolar bone plate fracture and gingival lacerations using physics forceps compared to conventional forceps. The physics forceps applies a constant and steady pressure with the wrist only that helps 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.[7] Kosinski also affirmed that the slow buccal movement applied by physics forceps was insufficient to fracture the buccal bone plate and immediate implant placement after Physics forceps tooth extraction showed better results in the post-operative phase.[8] El-Kenawy MH and Ahmed et al found buccal cortical plate fracture in 3% patients using physics forceps and in 7% patients using conventional forceps out of 100 patients sample each. These results are in agreement with our study.[5] Sonune et al in his study found insignificant difference in gingival laceration using physics forceps and stated careful retraction during extraction can avoid gingival laceration with any of the forceps.[9] Patel et al found marginal bone loss and soft tissue loss was also significantly lesser in physics forceps group when compared to conventional forceps group.[10]

Mandal et al in their study reported 23 out of 25 subjects with no laceration in physics forceps group whereas in 1 subject laceration was present, and in conventional forceps group 8 subjects reported the presence of laceration out of 25 patients and 2 subjects were reported as failure.[11] The results of these studies are in accordance with our study. Less requirement of post extraction suturing was found in Physics forceps group in our study due to lesser soft and hard tissue injuries in this group. In our study duration for extraction procedure was compared. It was found that the time required to extract using physics forceps was significantly lesser compared to that of conventional forceps (p<0.001). Mandal et al in their comparative study also reported the similar results with mean extraction time of 1.868 minutes using physics forceps and 2.584 minutes using conventional forceps whereas Hariharan et al in their study found insignificant difference in extraction time with mean operating time of 29.4 seconds using Physics forceps and 43.5 seconds using universal extraction forceps.[11,12]

For post-operative pain assessment, at 4 hours and 8 hours duration the difference of pain between two groups was significant, and the pain was more for conventional forceps group with the mean difference of 0.82 and 0.71 respectively (p value=0.007 and 0.006 respectively). At other duration intervals pain difference was not statistically significant. Pain can vary from person to person and in same person at different times.

Postoperative pain due to injured hard tissues may be from a fracture of cortical bone plate during instrumentation or due to injury to the soft tissues. Correct technique to prevent cortical bone fracture and proper socket cleaning can prevent this pain. Soft tissues may be damaged in several ways. If a muco-periosteal flap is not retracted properly, much traumatic retraction may be required to secure access to the forcep and if the soft tissues are not properly protected, they may become entangled with beaks of the forceps. Since the beaks of the physics forceps secures grip subgingivally only on one side (lingual/palatal) and bumper supports soft tissues on buccal side, soft and hard tissues injuries are found less with Physics forceps which lead to lesser postoperative pain.

The results are at par with the study of Hariharan et al in which the VAS for pain differed between the groups as the sockets from which the teeth had been removed by the Physics forceps had significantly less pain on the first postoperative day than conventional forceps group.[12] Patel et al measured postoperative pain on VAS scale on 1st and 3rd post-op day.[10] Mean VAS score on 1st post-op day using physics forceps and conventional forceps were 3.19 and 3.71 respectively. Mean VAS score on 3rd post-op day using physics forceps and conventional forceps were 1.04 and 1.14. However, the difference in pain score using either forceps was not statistically significant. Madathanapalli et al found statistically significant pain difference on 3rd day with lesser pain in Physics forceps group while there was no difference seen on the 5th and 7th post-operative day.[13] In our study the mean difference of number of analgesics consumed was statistically insignificant (p=0.53). In conventional forceps group 17 patients did not take any analgesics post-operatively while in physics forceps group 16 patients did not take any post-operatively which is statistically and clinically insignificant. So, no significant difference was found between two groups for analgesic intake.

Limitations

Limitations of the study is that all the 200 patients collective data for extractions was done by three operators which can affect the results

CONCLUSION

It is concluded in our study that traumatic extraction can be avoided with the use of physics forceps with lesser operating time compared to conventional forceps. As the procedure is done in atraumatic manner with minimal manipulation of hard and soft tissue, post-operative extraction pain is minimized with uneventful healing**.** The advantage of our study is that it is a single operator study as all extractions were done by same surgeon. The disadvantages of the study are the cost of Physics forceps compared to conventional forceps with long learning curve even for an experienced practitioner.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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