

## Original Research Article

# Comparative evaluation of efficacy of physics forceps versus conventional forceps in therapeutic extractions of premolars: a prospective clinical study

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## ABSTRACT

**Background:** Dental extraction is the removal of a tooth from the oral cavity and is the most common procedure performed in oral surgery. Conventional exodontia tends to cause unnecessary trauma leading to postoperative pain, loss of tissue and stress for the patient. 'Atraumatic' dental extraction techniques have nowadays gained popularity and in such case, physics forceps can be helpful in achieving such results. The aim of the study was to evaluate and compare efficacy of physics forceps versus conventional forceps in therapeutic extraction of premolars.

**Methods:** A total of 35 patients requiring extraction of premolars in maxillary or mandibular arch or both arches for orthodontic treatment purpose were included and divided into groups A and B wherein right sided extractions performed with physics forceps were compared with left sided extractions carried out using conventional forceps in terms of time taken for extraction, bone and soft tissue injury, success score and pain assessment.

**Results:** The present study suggested statistically significant difference between both the groups. Time taken for extraction, trauma to gingival tissue, bone loss, and visual analogue scale (VAS) score was significantly lesser with physics forceps group, when compared to conventional forceps group. Moreover no significant difference in success score was noted between both the groups.

**Conclusions:** 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:** Atraumatic extraction, Bone loss, Extraction forceps, Physics forceps, Soft tissue loss

## INTRODUCTION

Dental extraction or exodontia is the removal of a tooth from the oral cavity and is thus the most common procedure performed in oral surgery.<sup>1</sup> Conventional exodontia involves use of the forceps to grasp the tooth, expansion of the alveolar bone, and then separation of the periodontal attachment using elevators, to pull out the tooth. This pulling technique also invites unnecessary trauma including broken roots and bone, this results in

inflammation and postoperative pain, loss of tissue, and stress for the patient and dental team. However, if the operator could utilize just two opposing forces, and these two forces eliminated the need for the third force that is the clinician's arm, the risk of fracturing the dental structures would be dramatically reduced. There would also be significantly less discomfort for the patient.

Traumatic damage to the dento-alveolar housing during extraction can result in noticeable deformities in alveolar

ridge and healing along with compromising of esthetics, such deformities may preclude dental implant placement or it may result in sub-pontic food trapment beneath traditional fixed partial dentures.

'Atraumatic' dental extraction techniques have gained popularity and may finally become the standard technique for teeth removal. Atraumatic extraction can preserve bone, gingival architecture, 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, periotome, powered periotomes, piezosurgery system and benex extractor.

Physics forceps were developed at golden dental solutions, Michigan designed by Dr. Richard Golden in 2004. The biomechanical design of this instrument decreases the chances of fracture of root, and maintains the buccal cortical plate, which is important for the proper healing of an immediately placed dental implant.<sup>2</sup>

Physics forceps have a 'beak and bumper' design that enables the operator to extract teeth using wrist movement only. They act like a simple first class lever. One of the force is applied using the beak on the lingual aspect of the tooth or root. The second force is applied via the 'bumper', which is placed on the alveolar ridge at the approximate location of the mucogingival junction. Steady rotational force is only applied over the handles of the forceps through a small amount of wrist movement by about 3-4° and maintaining this position for about 30 to 40 seconds, this will slowly expand the bone and periodontal ligament to release. The operator will soon feel the tooth disengage from the socket after which, operator can then remove the forceps and lift out the tooth using another appropriate instrument.<sup>3</sup> Concept of conservation of marginal bone following extraction of tooth is very important in the recent era of implantology. Physics forceps is proven to avoid the marginal bone loss by its developer GOLDEN/MISCH.<sup>3</sup>

## METHODS

### Study period

The study period was from January 2017 to January 2018.

### Study design

The design of the study was split mouth study.

### Study population

The population of the study was 35.

### Inclusion criteria

Participants referred to Department of Oral and Maxillofacial surgery requiring bilateral extractions of premolars in maxillary or mandibular arch or both the

arches for orthodontic treatment purpose. Participants with age group-18 to 40 years.

### Exclusion Criteria

Patients with teeth having abnormal root morphology as excluded by preoperative periapical X-ray examination. Patients with uncontrolled systemic disease, that compromise dental extraction. Participants with periodontally compromised tooth. Participants with restricted mouth opening <20 mm.

### Methodology followed

The study was conducted by using sample t-test.

### Statistical analysis

Group sample sizes of 25 achieve 80% power to detect a difference of 29.53 between the null hypothesis that both group means are 58.8 and the alternative hypothesis that the mean of group 2 is 88.33 with group standard deviations of 37 and with a significance level (alpha) of 0.050 using a two-sided two-sample t-test.

$$\text{Sample size} = 2 \times \left( \frac{Z\alpha}{2} + Z_1\beta \right)^2 / \left( \frac{m^1 - m^2}{\sigma} \right)^2$$

Where  $\frac{Z\alpha}{2} = 1.96$

$Z_1\beta = 0.84$

$m^1 = \text{mean of group 1} = 58.8$

$m^2 = \text{mean of group 2} = 88.33$

$\sigma = \text{standard deviation} = 37$

So final sample size is 25. This research would be performed considering 35 sample size. In every 35 patients, sub grouped into group A and B.

Group A: for right side maxillary and/or mandibular premolar, physics forceps will be used and group B: for left side maxillary and/or mandibular premolar, conventional extraction forceps will be used.

### Methodology

A total of 35 healthy adult 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.

After taking detailed case history, alginate impression of that dental arch and then cast were prepared. A self-cure acrylic template radiopaque in nature, covering the occlusal 1/3rd surface of tooth to be extracted and one tooth on either sides were made and placed intraorally and used as the reference point. Using UNC-15 (University of

North Carolina-15) probe, distance between gingival margin and the lower edge of template at mesial, middle and distal third region on the buccal side of tooth to be extracted was measured and values were recorded, which suggested pre extraction gingival level (PEG).

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, after giving appropriate regional nerve block for the tooth using 2% lignocaine containing 1:2,00,000 lignocaine hydrochloride and adrenaline (Figure 1 and 2). Elevators were not used for luxation.

Time taken for extraction was considered from the point of application of the beaks on the tooth to the delivery of tooth out of socket, were measured using stop watch and recorded in seconds.



**Figure 1: Upper right premolar extracted using physics forcep.**



**Figure 2: Lower left premolar extracted using conventional forcep.**

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.

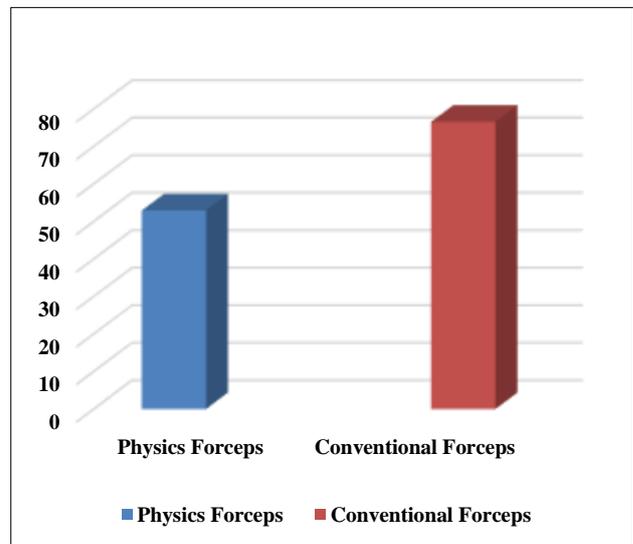
Success score for the procedure were given as by Choi et al. Postoperative pain evaluation were done using visual analogue scale (VAS).

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.

## RESULTS

### *Time taken for extraction*

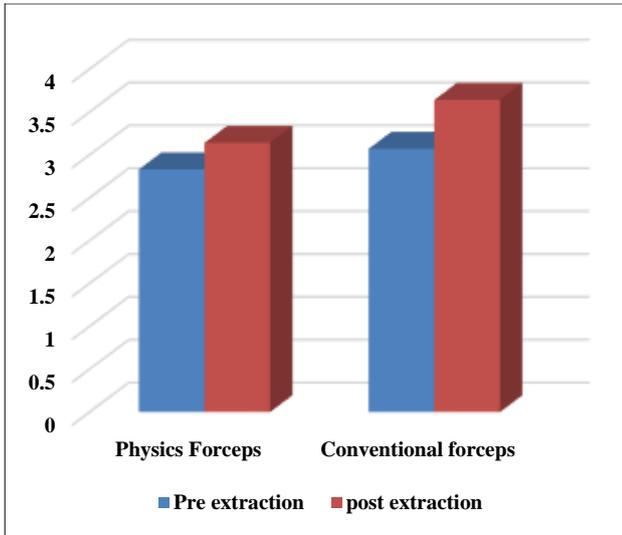
Mean time duration while using physics forceps for extraction was 52.96 sec while that of conventional forceps was 76.59 sec, which suggested that mean time duration while using conventional forceps was significantly higher when compared to physics forceps with p value of 0.001 (Figure 3).



**Figure 3: Time taken for extraction.**

### *Gingival architecture loss*

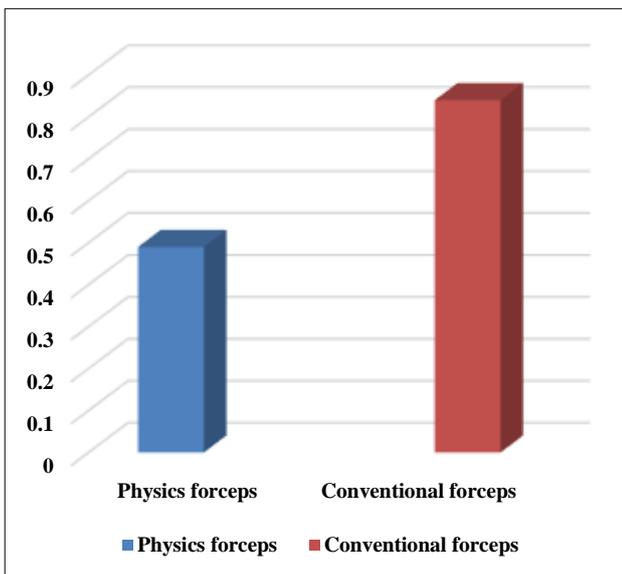
Mean gingival level pre and post extraction using physics forceps was 2.83 mm and 3.14 mm while for conventional forceps was 3.07 mm and 3.64 mm. Difference in pre and post level values were found to be significantly higher in conventional forceps group as compared to physics forcep group with p value of 0.002 and 0.001 respectively, which suggested that physics forceps were found to cause lesser trauma to the gingival tissues as compared to conventional forceps (Figure 4).



**Figure 4: Gingival architecture loss.**

**Bone loss immediate post extraction**

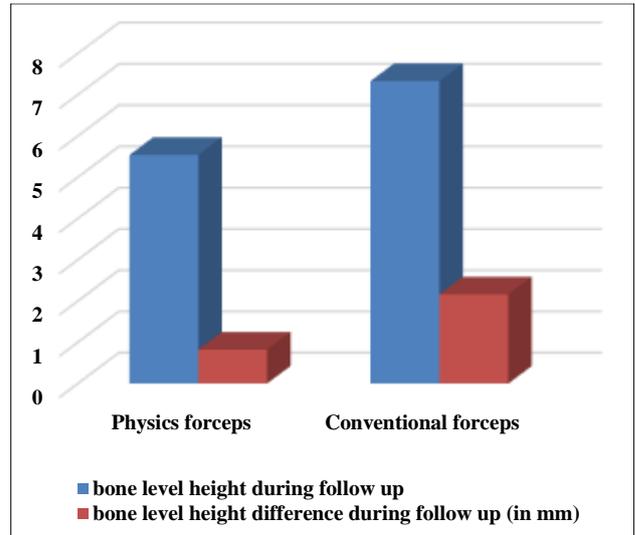
Mean bone level height difference immediate post extraction while using physics and conventional forceps were 0.49 mm and 0.84 mm and the difference was found to be significantly higher in conventional forceps as compared to physics forceps with p value of 0.001 (Figure 5).



**Figure 5: Bone level height difference immediate post extraction.**

**Bone loss during follow up (1 month)**

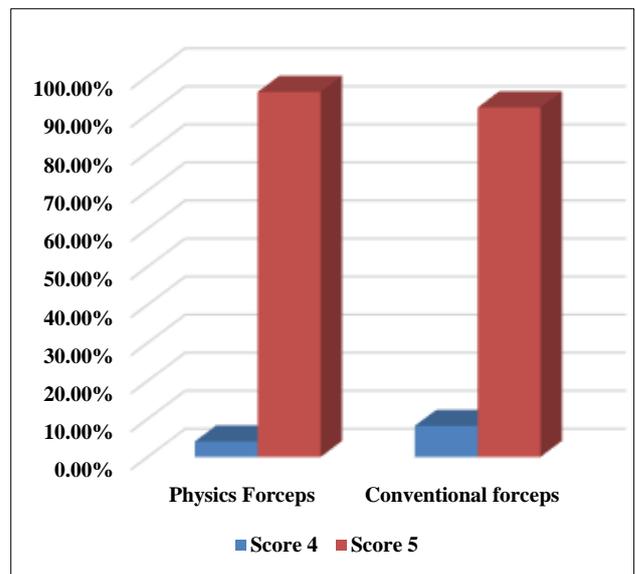
In present study, mean bone level height and difference while using conventional forceps was 7.33 mm and 2.16 mm whereas for physics forceps was 5.54 mm and 0.82 mm, which suggested to be higher in conventional forceps as compared to physics forceps with p value of 0.001 for each respectively (Figure 6).



**Figure 6: Bone loss during follow up (1 month).**

**Success score**

Success score was 5 in 95.92% extractions using physics forceps and 91.84% while using conventional forceps. Score was 4 in 4.08% extractions using physics forceps and 8.16% while using conventional forceps which suggested the score to be statistically insignificant (Figure 7).



**Figure 7: Success score.**

**VAS score for pain**

Visual analog scale (VAS) score post extraction was 2.94 in physics forceps and 5.57 in conventional forceps group and score was 0 in both groups during the 1-month follow-up, this suggests score is significantly improved in physics forceps as compared to conventional forceps with p value of 0.001 (Figure 8).

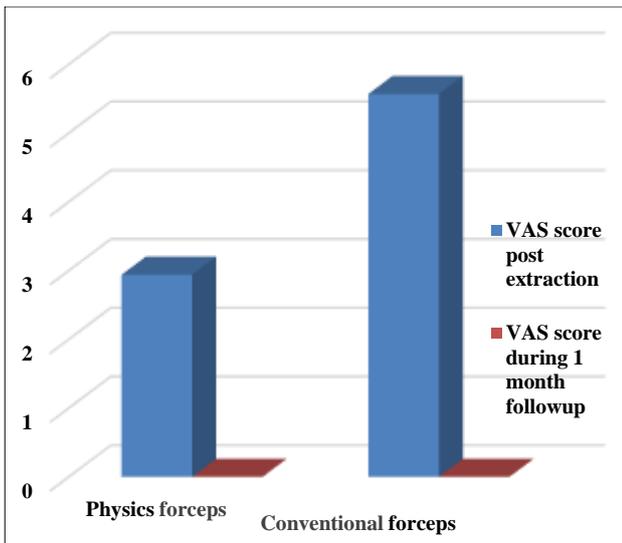


Figure 8: VAS score for pain.

## DISCUSSION

Atraumatic tooth extraction and socket preservation has nowadays become a necessity for the clinician as the conventionally designed forceps, have been known to create various complications like fractured roots, adjacent soft tissue laceration to fracturing of buccal cortical plate and interdental alveolar crest. These events result in inflammation and post-operative pain, loss of adjacent tissue, and stress for the patient and to the dental team. This trauma may lead to alveolar ridge defects, making the placement of implants and the other prosthesis a difficult task and even impossible in certain cases.

Various instruments and techniques have been developed to carry out atraumatic tooth extraction such as powered periostomes, piezosurgery, lasers, physics forceps, orthodontic extrusion of the third molar, and benex vertical extraction system.

Recently, a new designed apparatus in exodontia was developed named physics forceps, which uses first-class lever principle and stress distribution without the action of crushing, pulling or twisting forces, to atraumatically extract a tooth from its extraction socket. Physics forceps were developed at golden dental solutions, Michigan designed by Dr. Richard Golden in 2004.

While using physics forceps, no force is required to be passed on to the beak. As a result, the tooth does not fracture. The compressive force applied by the bumper onto the gingiva and bone is distributed over a larger surface area over buccal bone, this permits lingual plate to expand more and protects the buccal cortical plate from fracture<sup>4</sup>.

Physics forceps works on first-class lever and involves biological chemical reaction in periodontal fibers during

extraction which makes extraction much fast, efficient, easier and cause less trauma.<sup>3,5</sup>

Time taken to carry out tooth extraction can be considered from the time starting when the tooth is engaged with forceps till the tooth is extracted. In this study the mean time taken while using physics forceps was 52.96 seconds while it was more with conventional forceps at 76.59 seconds, this result are conferring with results reported by Long et al. Similar results were also noted by Patel et al in their study with mean value of extraction time of 58.8 seconds with physics forceps and 88.33 seconds while using conventional forceps.<sup>6</sup> Mandal et al. also in their study found same results with mean extraction time of 139.8 seconds with physics forceps and 236 seconds while using conventional forceps.<sup>4</sup>

Preservation of bone and gingival architecture is important aspect when teeth are extracted, and is of much importance for esthetics and after implant placement. In our study we found that mean gingival level differences at pre and post extraction was significantly higher while using conventional forceps as compared to physics forceps, which suggests physics forceps causes less gingival trauma. These results were similar with the study carried by Patel et al wherein the mean difference in the pre and post extraction level of gingiva using both forceps was 0.57 mm and 1.01 mm respectively.<sup>6</sup>

Physics forceps developed by GOLDEN/MISCH has been claimed to prevent the marginal bone loss as a result of mechanical design and even distribution of forces thereby preserves investing tissues.<sup>7</sup> In the present study, mean bone level height difference immediate post extraction when physics and conventional forceps were used was 0.49 mm and 0.84 mm which determines more trauma to bone, when conventional forceps were used. This result were in accordance with the study by Patel et al, wherein mean difference while using physics and conventional forceps was 1.26 mm ( $\pm 1.08$ ) and 1.87 mm ( $\pm 1.13$ ) respectively.<sup>6</sup>

Bone loss is bound to occur post tooth extraction and more traumatic the extraction is, more the bone loss. In our study, further bone loss was calculated during the follow-up period of one month and was found that mean bone level height difference during follow up while using physics and conventional forceps was 0.82 mm and 2.16 mm, which denotes more bone loss when conventional forceps were used and moreover study of this criteria, to our knowledge has not been reported in any other literature so far.

In the present study, success score for tooth extraction using both forceps was calculated based on criteria given by Choi et al.<sup>8</sup> When physics forceps were used, success score 5 (complete success) was obtained in 47 extractions (95.92%), score 4 (extraction involving root tip fracture) in 2 extractions (4.08%) while in case of conventional forceps, success score 5 was gained in 45 extractions

(91.84) and score 4 in (8.16%) which suggested insignificant difference between two groups. Choi et al also stated that physics forceps are more efficient hence less chances for crown and root fracture to occur.<sup>8</sup>

In the present study, pain score measured using visual analogue scale (VAS) for physics and conventional forceps group post extraction was 2.94 and 5.57, where 0 is no pain and 10 indicates worst possible pain. These results suggested lesser post-operative pain while using physics forceps and VAS score was 0 for both groups at the interval of 1 month. Study conducted by Patel et al showed no obvious difference in score on 1st and 3rd day post extraction between two groups.<sup>6</sup> Otherwise the results of the present study were in accordance with other studies conducted by Basheer.<sup>9</sup> Study conducted by Ramakrishna et al and Lingaraj et al showed significantly lesser pain on 1st and 3rd day post-extraction using physics forceps when compared to conventional forceps.<sup>10,11</sup>

Cost of the physics forceps and its kit is more on the expensive side and is subjective for the clinician to use it. Also the physics forceps kit once invested requires maintenance as the silicon bumpers attached undergo wear and tear with time and require replacement after certain use. Hence even though the physics forceps are beneficial comparatively to the conventional forceps, not all clinicians can take advantage of it.

Learning of physics forceps has been known to be easy and this directly depends on learning curve of the surgeon and his/her calibre, as a result the study may reflect changes based on the experience of the surgeon.

The present study included assessment of physics forceps and conventional forceps based on various criteria discussed earlier, apart from these there are certain different criteria's which the present study didn't accessed such as Patel et al accessed pain on 1st and 3rd day post extraction.<sup>6</sup> Basheer accessed buccal cortical plate fracture, bleeding post extraction and healing of the extraction socket.<sup>9</sup> Ramakrishna et al assessed criteria's such as alveolar fracture, post-operative infection, dry socket, delayed healing.<sup>10</sup> Madathanapalli et al also accessed oro-antral communication and damage to the surrounding tissue.<sup>12</sup>

In the present study, though certain criteria as described above were not accessed. Various complications such as alveolar fracture, dry socket, buccal cortical plate fracture, post extraction infection was not encountered.

## CONCLUSION

Physics forceps are an innovative designed extraction forceps. The technique for extraction is easy to learn and thus has a shallow learn curve.

Physics forceps have been found to provide less traumatic experience to the patient physically and psychologically

whilst it reduces the chair side time and increases the operator confidence. Hence offers the clinician an easy way to extract some of the challenging extractions.

The result obtained in the present study showed that, there was statistically significant difference with time taken for extraction, gingival tissue injury, bone loss, VAS score for pain when both physics and conventional forceps were compared, whereas success score were found to be statistically insignificant between both the groups.

Hence the results conclude that 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.

Moreover further research is still required, to be carried out over a bigger group of patients and over the other molar posterior teeth to evaluate the efficacy over the other dentitions.

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