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Original Research

Comparing Physics Forceps vs Conventional Forceps in Orthodontic Extractions of Bilateral Premolars

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ABSTRACT:

Introduction: Tooth extraction is among the most frequently conducted procedures in dentistry. However, it is typically traumatic, often leading to the immediate loss of alveolar bone and surrounding soft tissue. To minimize such damage, various instruments have been introduced to facilitate atraumatic extractions. One such innovation is the recently developed physics forceps, which is designed to extract teeth with minimal trauma to the paradental structures. **Aim:** The aim of this study was to evaluate and compare the effectiveness of physics forceps and conventional forceps in bilateral premolar extractions performed for orthodontic purposes, focusing on operating time, postoperative pain, and associated complications. **Materials and methods:** This prospective split-mouth study compared outcomes between two groups (n = 24 premolars) undergoing premolar extractions for orthodontic purposes using either physics forceps or conventional forceps. Clinical parameters assessed included extraction time, postoperative pain, and other extraction- related complications. **Results:** Statistically significant reduction in the operating time was noted in physics forceps group. However, there was no statistically significant difference in severity of postoperative pain between both groups. **Conclusion:** The results of the present study suggest that physics forceps were more efficient in reducing operating time and prevention of associated complications in orthodontically indicated premolar extractions.

Keywords: Atraumatic extraction, physics forceps , conventional forceps, complications.

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INTRODUCTION

Tooth extraction is one of the oldest and most widely practiced procedures in dentistry, dating back to the earliest days of human civilization. For centuries, it remained the sole dental intervention performed, leading to the development and evolution of various extraction instruments. In the 14th century, Guy de Chauliac introduced the dental pelican, an instrument that remained in use until the late 18th century. It was later succeeded by the dental key, which was eventually replaced in the 20th century by modern extraction forceps. Conventional tooth extraction forceps, commonly used today, are metallic tools featuring two beaks for grasping the tooth crown, a central hinge, and handles for operator control.

Despite advancements in design, tooth extraction remains a traumatic procedure, often causing immediate damage to the alveolar bone and surrounding soft tissues. The technique employed and the choice of instrument significantly influence the extent of paradental tissue loss. Over the last decade, there has been growing interest in atraumatic extraction techniques, particularly to preserve alveolar bone for future dental implant placement. Maintaining the integrity of the marginal alveolar ridge is crucial for achieving favourable functional, aesthetic, and orthodontic outcomes.

To address the limitations of traditional methods, various modern instruments and techniques have been developed to minimize trauma to the surrounding tissues during extraction. These include periotomes, powered periotomes, Physics Forceps, the Benex

extractor, and other specialized tools that aid clinicians in performing extractions more efficiently, predictably, and with reduced patient discomfort.

The Physics Forceps, developed by Golden Dental Solutions in Michigan, operate based on biomechanical principles, specifically those of a first-class lever, creep, and controlled stress distribution. Unlike conventional forceps, they avoid squeezing, twisting, or pulling forces, allowing for an atraumatic extraction process. Conventional forceps typically apply equal pressure on the buccal and lingual aspects of the tooth, relying on the operator's wrist and arm movement to elevate the tooth. This conventional technique often results in complications such as root fractures, bone loss, and soft tissue damage.

AIM

The aim of the present study was to evaluate the efficacy of physics forceps in premolar teeth extraction for orthodontic purpose and compare it to conventional forceps in terms of time taken for extraction, measuring postoperative pain and occurrence of complications.

MATERIALS AND METHODS

Six patients who reported to the Department of Oral and Maxillofacial Surgery at National Dental College and Hospital, Derabassi, between January 2025 and April 2025, were included in this study. All patients required bilateral extractions of both upper and lower first premolars as part of their orthodontic treatment and provided informed consent to participate. A total of 24 extractions were performed (four first premolars per patient).

In each case, the choice of forceps system (conventional or Physics) for the first extraction was determined by a coin toss. The alternate system was then used for the next extraction, ensuring both systems were used in each patient.

All patients underwent appropriate pre-surgical preparation, including detailed case history, necessary blood investigations, and radiographic evaluation (either orthopantomogram or intraoral periapical radiograph of the teeth to be extracted). Patients were excluded if they had absolute contraindications to extraction, or if the teeth to be removed were mobile, carious, mal-aligned, or required trans-osseous extraction.

All extractions followed standard aseptic surgical protocols. Local anesthesia containing 1:80,000 Lignocaine Hydrochloride with adrenaline was administered using a 24-gauge disposable syringe, employing both regional nerve blocks.

Reflection of the mucoperiosteal flap using a periosteal elevator was performed only during extractions with conventional forceps. Elevators were not used to luxate the teeth prior to extraction. Tooth-specific forceps were applied at the cementoenamel junction (CEJ) to deliver tooth-specific movements for extractions using the conventional system [Table/Fig-3b]. In contrast, the Physics forceps system involved placing the beak on the lingual or palatal aspect of the tooth at or below the CEJ, with the bumper positioned on the buccal alveolar ridge at the mucogingival junction. A constant and controlled traction force was applied until the tooth was dislodged from the socket.

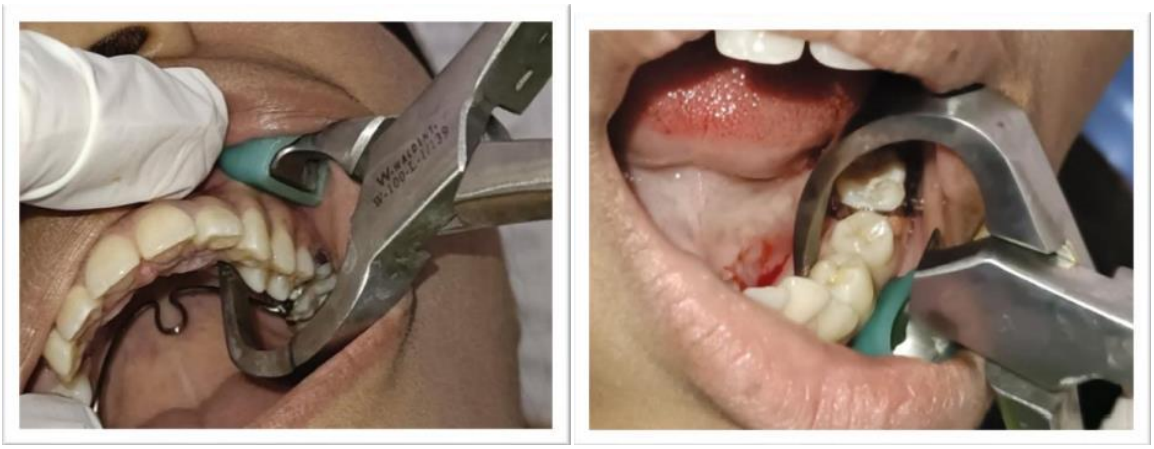
The time required for each extraction was recorded using a stopwatch, measured from the moment the forceps beaks were applied to the tooth until its removal from the socket, and documented in seconds. No socket compression was performed post-extraction. Each extracted tooth was examined clinically for root fractures or the presence of buccal plate remnants adherent to the root.

Following the procedure, a Betadine-soaked gauze pressure pack was placed over the extraction site, and all patients received standardized post-extraction instructions.

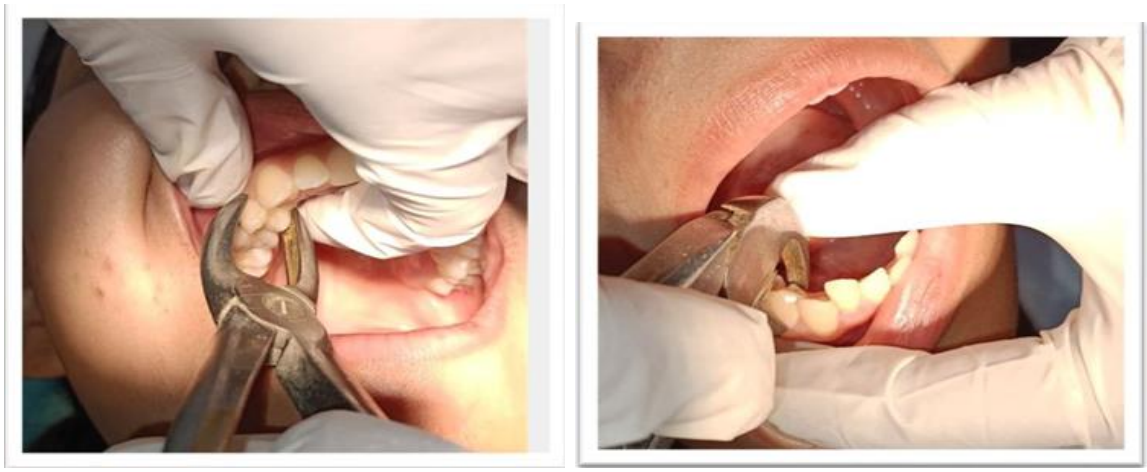
Postoperative pain was evaluated using VAS (Visual Analogue Scale) (Pasqualini et al 2005) at 1st and 3rd day Postoperatively.

SCORE	PAIN
0	No Pain - The patient feels well
1	Slight pain -The patient is distracted, he/she does not feel the pain
2	Mild pain - The patient feels pain even if concentrating on some activity
3	Severe pain -The patient is very disturbed but nevertheless can continue with normal activities
4	Very severe pain - The patient is forced to abandon normal activities
5	Extremely severe pain - The patient must abandon every type of activity and feels the need to lie down

All the patients were prescribed following medications: Cap. Amoxicillin 500mg (TID)-3days Tab. Diclofenac Sodium 50mg (BID)-3 days



EXTRACTIONS USING PHYSICS FORCEPS



EXTRACTION USING CONVENTIONAL FORCEPS

STATISTICAL ANALYSIS

The collected data was tabulated and analysed using graphpad software. Unpaired Student t- test was used for probability measurements.

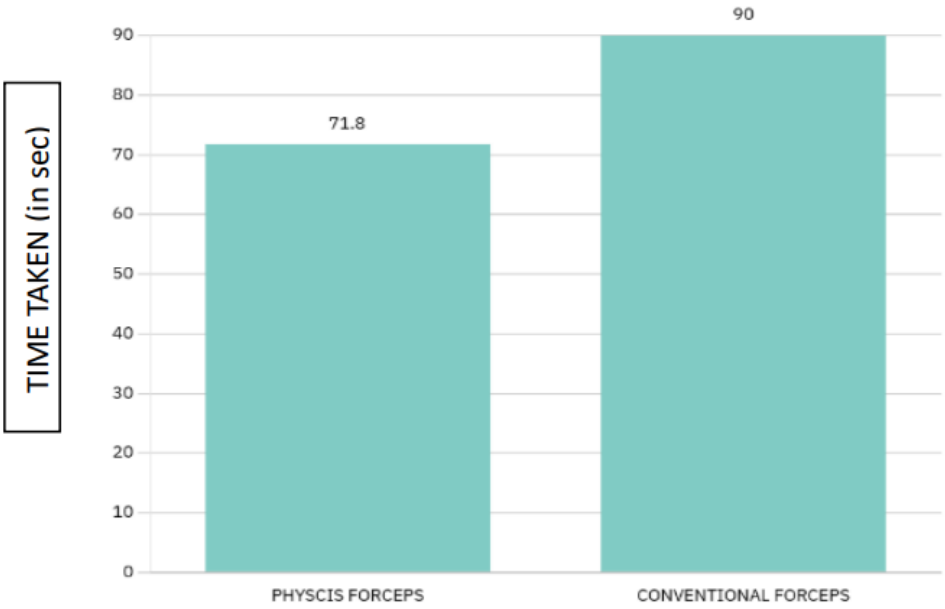
RESULTS

This split mouth study included 6 patients, 2 males and 4 females with mean age of 18.5 years and age range was 15-22 years. Total 24 premolar extractions were included in the study. Six patients underwent extractions of all 4 first premolars.

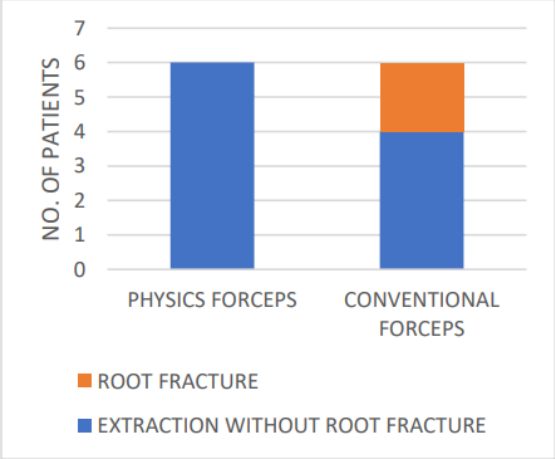
Pain Score: Postoperative pain measured on VAS scale was recorded on 1st and 3rd post-op day. Mean VAS score on 1st post-op day using physics forceps and conventional forceps were 2.3 and 3.8 respectively with p value of 0.0079 (very significant). Mean VAS score on 3rd post-op day using physics forceps and conventional forceps were 1 and 1.6 (p value = 0.0959).

Extraction time: The mean time taken for extraction using Physics forceps was 71.8 sec while that with conventional forceps were 90 sec. When subjected to student t-test ,this difference was found to be statistically significant with p value = 0.0373 < 0.05.

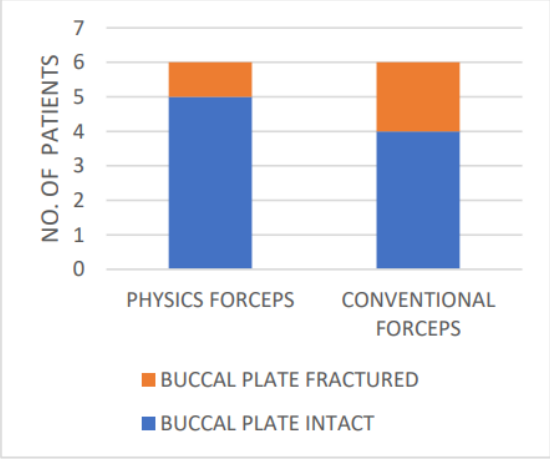
Root and buccal cortical plate fracture: Root tip fracture occurred in 2 teeth extracted using conventional forceps which was not seen in extractions done with physics forceps. Fracture of buccal cortical plate which remained adhered to roots of extracted teeth was found in 1 teeth extracted using physics forceps and in 2 teeth using conventional forceps.



Time taken for extraction by physics and conventional forceps



Occurrence of root fracture



Occerence of buccal plate fracture

DISCUSSION

Tooth extraction requires precision and controlled force to achieve atraumatic removal. Various instruments and techniques have been developed to aid in this process. The Physics forceps, in particular, offer distinct advantages over conventional forceps due to their unique design, which functions as a first-class lever to provide significant mechanical advantage.

Unlike conventional forceps, which require a squeezing motion, the Physics forceps use a rotational wrist movement. The buccal beak is replaced with a plastic-covered bumper that rests apically in the vestibule. The beak is positioned on the palatal or lingual surface of the tooth at or below the cementoenamel junction (CEJ). The forceps handle measures 8 cm from the bumper, while the distance from the bumper to the beak is 1 cm. This configuration generates torque that amplifies the applied force by approximately eight times. The compressive force applied by the bumper is distributed over a broad area of gingiva and bone, reducing the risk of tooth or alveolar fracture. Once the tooth is sufficiently loosened, it can be removed using conventional forceps or a rongeur.

Conventional dental forceps operate as class II levers with a hinge, where the handles apply force, the beaks serve as the load arm, the hinge acts as the fulcrum, and the tooth is the load. This setup primarily aids in gripping the tooth but offers limited mechanical advantage for extraction.

According to Dym and Weiss, the Physics forceps eliminate the need for flap reflection or the use of elevators, which is particularly beneficial in cases requiring atraumatic extraction.

The duration of the extraction was measured from the initial engagement of the tooth to its complete removal from the socket. Physics forceps apply a consistent, unidirectional traction force, whereas conventional forceps require a combination of buccal, lingual, and rotational forces. This increased manipulation can prolong intraoperative time.

In the present study, the mean extraction time was significantly shorter with Physics forceps compared to conventional forceps, consistent with findings by Long et al. (International Association of Dental Research, 2010). Mandal et al. also reported similar results, with mean extraction times of 139.8 seconds for Physics forceps and 236 seconds for conventional forceps.

Preservation of marginal bone is crucial, especially in the context of implantology. According to its developers (Golden/Misch), Physics forceps minimize marginal bone loss. In this study, marginal bone levels post-extraction were quantitatively assessed using a Williams probe—a novel approach, to our knowledge. Significantly less bone loss was observed in the Physics forceps group.

Buccal cortical plate fractures occurred in 2 patients (4.76%) in the Physics forceps group during early use, possibly due to the operator's learning curve—a factor also mentioned by Perkins NJ et al. (British Association of Oral and Maxillofacial Surgeons, 2010).

Postoperative pain was measured using the Visual Analogue Scale (VAS) on days 1 and 3. Although differences were not statistically significant, mean pain scores were lower in the Physics forceps group, likely due to reduced tissue trauma. These results are comparable to those of S. Hariharan et al., who noted significantly lower pain on the first postoperative day in the Physics forceps group.

Complications, while rare, can extend treatment and patient morbidity. In this study, root tip fractures occurred in 4.76% of cases, all within the conventional forceps group. The overall success rate was 96% for Physics forceps and 90% for conventional forceps, consistent with the 93% success rate reported by Choi et al.

Mild swelling on the first postoperative day was observed in 2.38% of Physics forceps extractions and 4.76% of conventional forceps extractions. Tooth fractures (including crown and root fractures) occurred in 6% of all extractions—3% in each group. Buccal cortical fractures occurred in 4.76% of conventional forceps extractions but were absent in the Physics forceps group, consistent with Mandal et al.'s findings.

No other complications were recorded. This split-mouth design minimized patient-related biases (e.g., nutrition, oral hygiene, bone quality) and operator-related variables, as all procedures were performed by a single clinician.

However, the use of Physics forceps is limited to patients with adequate mouth opening and anatomically aligned teeth.

CONCLUSION

Based on the findings of the present study, it can be concluded that extractions performed with Physics forceps are less invasive compared to those using conventional forceps and can be regarded as a reliable method that requires comparatively less intraoperative time.

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