Comparison Between Physics and Conventional Forceps in Simple Dental Extraction

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Abstract

Background 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. The biomechanical design of physics forceps 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.

Purpose This study was conducted to evaluate the efficacy of physics forceps versus conventional forceps in simple dental extraction.

Patients and Methods 200 adult patients seeking simple dental extraction were selected from the Outpatient Clinic in the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Mansoura University, Egypt. The selected patients were randomly allocated into two groups: group I: included 100 patients, in this group extraction was done using physics forceps, and group II: included 100 patients, in this group extraction was done using conventional forceps.

Results In physics forceps group: crown fracture occurred in three cases (3 %), buccal bone fracture occurred in three cases (3 %), and root fracture occurred in 14 roots (8.5 %),

while in conventional forceps group: crown fracture occurred in 10 cases (10 %), buccal bone fracture occurred in seven cases (7 %), and root fracture occurred in 27 roots (16.6 %).

Conclusion Physics forceps are innovative extraction instruments. By using them, it is possible to perform difficult extractions, with predictable results, and without need to reflect a flap. Using physics forceps decreases the incidence of crown, root, and buccal bone plate fractures, in comparison to the conventional forceps.

Keywords Dental extraction · Physics forceps · Conventional forceps

Introduction

Dental extraction (exodontia) is the removal of a tooth from the mouth. Exodontia is the most common procedure performed in oral surgery, and it is often the first surgical procedure carried out by young dentists [1].

Although all possible measures should be taken to preserve and maintain teeth in the oral cavity, it is still necessary to remove some of them. Teeth are extracted for a variety of reasons, including: severe caries, severe periodontal disease, orthodontic reasons, malopposed teeth, cracked teeth, preprosthetic extractions, impacted teeth, supernumerary teeth, teeth associated with pathologic lesions, preradiation therapy, teeth involved in jaw fractures, esthetics, and economics [2].

An ideal tooth extraction may be defined as the painless removal of the whole tooth or tooth roots with minimal trauma to the investing tissues, so the wound heals uneventfully with no postoperative prosthetic problems [3].

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The ultimate goal of traditional extraction techniques is removal of the tooth from its dentoalveolar housing. In certain circumstances, achieving this goal involves fracturing or surgical removal of surrounding bone. Traumatic damage to the dentoalveolar housing during extraction can result in significant ridge deformities upon healing. In addition to compromising esthetics, such deformities may preclude dental implant placement or result in sub-pontic food trapment beneath traditional fixed partial dentures [4, 5].

“Atraumatic” dental extraction techniques have gained prominence and may ultimately become the standard technique for teeth removal. Atraumatic extraction preserves bone, gingival architecture, and allows for the option of future or immediate dental implant placement [6–8]. 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 were designed by Dr. Richard Golden in 2004; 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 [9].

Conventional forceps are actually two first-class levers, connected with a hinge. The forceps handles are the long side of the lever, the beaks on the tooth are the short side of the lever, and the hinge acts as a fulcrum. The force on the handles is magnified to allow the forceps to grasp the tooth with great force. None of these forces are used to extract the tooth. Rather, increased forces may crush or fracture the tooth. The handles of the forceps allow the doctor to grasp the tooth, but do not assist in the mechanical advantage to remove it [10].

Patients and Methods

Patients

Two hundred adult patients seeking simple dental extraction were selected from the Outpatient Clinic in the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Mansoura University, Egypt, according to the following inclusion and exclusion criteria:

Inclusion Criteria for Both Conventional and Physics Forceps Groups

- Patients with teeth having 3 mm or more of intact tooth structure above the gingival margin with at least the minimum of 2 intact surfaces.

Exclusion Criteria for Both Conventional and Physics Forceps Groups

- Patients with teeth having abnormal root morphology (as dilacerated, severely curved, bulbous roots, etc.) as depicted by preoperative periapical X-ray examination.
- Patients with uncontrolled systemic disease, that compromise dental extraction.
- Patients requiring extraction of wisdom teeth.

Informed Consent

Informed consent was taken from every participant “according to Helsinki declaration”.

The study protocol was approved by the Medical Ethics Committee at Mansoura University.

Patients Grouping

The selected patients were randomly allocated into two groups:

Group I (physics forceps group): included 100 patients, in this group extraction was done using physics forceps.

Group II (conventional forceps group): included 100 patients, in this group extraction was done using conventional forceps.

Physics forceps:¹

- Upper right (Fig. 1): used to extract upper right posterior teeth.
- Upper left (Fig. 2): used to extract upper left posterior teeth.
- Upper anterior (Fig. 3): used to extract upper anterior teeth.
- Lower universal (Fig. 4): used to extract all lower teeth.

Methods

Anesthesia

Local anesthesia was induced with 2 % mepivacaine HCL with 1:20,000 levonordefrine using buccal and palatal infiltrations for the upper teeth, and inferior alveolar and lingual nerve blocks for the lower teeth supplemented with buccal infiltration for lower molars.

¹ Zurich International—Pakistan.

Fig. 1 Upper right physics forceps **Fig. 2** Upper left physics forceps **Fig. 3** Upper anterior physics forceps **Fig. 4** Lower universal physics forceps

Steps of Dental Extraction by Physics Forceps [11]

Extraction using the physics forceps was done in the following sequence:

- The lingual gingival attachment was separated from the tooth using mucoperiosteal elevator (Figs. 5, 9).
- The forceps handles were opened widely; the beak was set into the depth of the lingual or palatal sulcus on solid root surface. A secure purchase point on solid root surface is critical to successfully rolling out the tooth. The bumper (which is covered by plastic or rubber to avoid trauma to the buccal soft tissues) was set perpendicular to the tooth at about the level of the mucogingival junction. That position was held securely without squeezing the handles (Figs. 6, 10).
- A steady and slow rotational force was applied in the direction of the bumper without squeezing the handles

or moving the arm, until the tooth becomes loose (Figs. 7, 11).

- If the tooth did not elevate sufficiently from the socket, it was grasped with hemostat or conventional forceps to lift it out (Figs. 8, 12).

Data Collection

Data were recorded on scannable case report forms, including: age, gender, tooth type,

Crown fracture (no fracture = 0, fracture = 1),

Root fracture (no fracture = 0, fracture of one root = 1, fracture of two roots = 2, fracture of three roots = 3), and

Bone plate fracture (no fracture = 0, fracture of buccal bone plate = 1)

Fig. 5 Separation of the lingual gingival attachment from the tooth using mucoperiosteal elevator

Fig. 7 A steady and slow rotational force was applied in the direction of the bumper

Fig. 6 Position of the physics forceps: the beak was positioned into the lingual gingival sulcus and the bumper was positioned perpendicular to the tooth at the level of the mucogingival junction

Results

This study included 200 patients, 136 males and 64 females with mean age 42.6 ± 15.9 :

- In physics forceps group: Mean age was 46.5 ± 16.5 .

Fig. 8 Final removal of the tooth by conventional forceps

- In conventional forceps group: Mean age was 41.6 ± 15.1 .
- There was no significant difference between the two groups regarding age ($P = 0.14$) (Figs. 9, 10, 11, 12).

Comparison Between the Two Groups Regarding Crown Fracture (Tables 1, 2)

Crown fracture occurred in 13 cases:

Fig. 9 Separation of the lingual gingival attachment from the tooth using mucoperiosteal elevator

Fig. 10 Position of the physics forceps: the beak was positioned into the lingual gingival sulcus and the bumper was positioned perpendicular to the tooth at the level of the mucogingival junction

- 3 (4 %) in group I.
- 10 (10 %) in group II.
- The difference between the two groups was statistically significant ($P = 0.04$).

Roots fracture occurred in 41 roots:

- 14 (8.5 %) in group I.
- 27 (16.6 %) in group II.

Fig. 11 A steady and slow rotational force was applied in the direction of the bumper

Fig. 12 Final removal of the tooth by conventional forceps

There was significant difference between the two groups ($P = 0.027$).

Comparison Between the Two Groups Regarding Bone Plate Fracture (Tables 1, 2)

Bone plate fracture occurred in 10 cases from which:

- 3 (3 %) in group I.
- 7 (7 %) in group II.
- There was no significant difference between the two groups ($P = 0.19$).

Table 1 Type and number of extracted teeth, number of crown fractures, number of buccal bone plate fractures, and number of fractured roots in physics forceps group

Extracted teeth	No. of extracted teeth	No. of crown fracture	No. of buccal bone plate fracture	No. of teeth with			No. of roots	No. of fractured roots
				One root	Two roots	Three roots		
Upper incisors	4			4			4	
Upper canines	4		1	4			4	
Upper 1st premolars	18	2	1	4	13	1	33	4
Upper 2nd premolars	8			6	2		10	
Upper 1st molars	10					10	30	5
Upper 2nd molars	4				1	3	11	
Lower incisors	8		1	8			8	
Lower canines	4			4			4	
Lower 1st premolars	12			12			12	
Lower 2nd premolars	6			6			6	
Lower 1st molars	16	1			16		32	5
Lower 2nd molars	6			1	5		11	
Total	100	3 (3 %)	3 (3 %)				165	14 (8.5 %)

Table 2 Type and number of extracted teeth, number of crown fractures, number of buccal bone plate fractures, and number of fractured roots in conventional forceps group

Extracted teeth	No. of extracted teeth	No. of crown fracture	No. of buccal bone plate fracture	No. of teeth with			No. of roots	No. of fractured roots
				One root	Two roots	Three roots		
Upper incisors	4			4			4	1
Upper canines	2		1	2			2	
Upper 1st premolars	16	3	2	2	14		30	6
Upper 2nd premolars	7	1		6	1		8	1
Upper 1st molars	12	2	1			12	36	6
Upper 2nd molars	3					3	9	2
Lower incisors	10		1	10			10	
Lower canines	4		1	4			4	
Lower 1st premolars	14	1		14			14	1
Lower 2nd premolars	10	1	1	10			10	
Lower 1st molars	16	2			16		32	9
Lower 2nd molars	2				2		4	1
Total	100	10 (10 %)	7 (7 %)				163	27 (16.6 %)

Discussion

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. This study aimed to compare between physics and conventional forceps regarding fracture of the crown, roots, and alveolar bone plates.

The main advantage of physics forceps over conventional forceps is related to their unique design that can deliver a powerful mechanical advantage by employing an efficient first-class lever. The extraction technique differs from any other extraction technique in that the buccal portion of the forceps is not a beak, but rather a plastic-covered bumper which is placed apically in the vestibule, creating a more efficient class I lever system [10].

By combining the biomechanical advantages of a first-class lever with the biochemical reaction, extraction of the

teeth became easier with physics forceps than conventional type with less incidence of crown and root fracture. When the periodontal ligament was traumatized with forceps or elevators, hyaluronidase was released. Once this chemical breakdown of the periodontal ligament by hyaluronic acid was sufficient, the tooth was released from its attachment to the alveolus and could be removed. This explains why the physics forceps with its steady trauma to the periodontal ligament quantitatively creates a greater release of hyaluronidase than traditional forceps or elevator extractions because the trauma from those techniques was intermittent. This is what makes the physics forceps more efficient, and causes less crown and root fracture [10].

These results were in agreement with the study of Choi et al. [12] who used physics forceps to extract teeth for intentional replantation (IR) and they concluded that, physics forceps could be considered as a reliable extraction method for safe and successful IR; it is expected to contribute greatly to save natural teeth.

In addition, the beak of the physics forceps is designed to apply control pressure parallel to the long axis of the root, and the bumper acts as a simple fulcrum or pivot point, so there were no squeezing forces applied to the beak of the physics forceps; because of that the tooth does not split, crush or fracture. Traditional forceps grasp, squeeze, twist, and exert crushing forces on the crown leading to increase in the incidence of crown fracture in conventional forceps group. These results were concomitant with the study of Misch and Perez [10], 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. In addition 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 [8] who stated that the buccal movement applied by physics forceps was slow and generally insufficient to fracture the buccal bone plate.

Finally, can physics forceps replace conventional forceps in routine dental extraction? It is suggested from this study that the physics forceps and its associated beak and bumper technique is clinically valuable in atraumatic tooth removal and in preserving the buccal bone plate, which is mainly critical for implant dentistry.

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Conflict of interests There is no conflict of interests.

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