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## RESEARCH ARTICLE

# PHYSICS FORCEPS – A NEW REVOLUTION IN EXODOTIA

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**ABSTRACT**

The present Exodontia is a procedure that all dentists are taught to perform in dental school and used by most general clinicians in their practice. With the growth of implant dentistry because of its high success rate and predictability, more questionable teeth that in the past may have been salvaged through extreme endodontic or periodontic procedures are now extracted for implant placement. A good skill set in basic and complex exodontia is therefore essential for well-trained general dentists who wish to be clinically involved in this facet of their practice. The purpose of this article is to review the biomechanics of a newly developed extraction forceps and to provide the literature supporting its advantages over the other commercially available forceps, elevators or periotome.



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## INTRODUCTION

The history of dental extractions dates back to the days of Aristotle (384 to 322 BC), in which he described the mechanics of extraction forceps, including the advantages of "two levers acting in contrary sense having a single fulcrum." (Ring, 1985). This was 100 years before Archimedes reported on the principles of the lever. Abulkasim (1050 to 1122 AD) was the first to apply a single lever (an elevator) under the tooth to force it from its bed (Atkinson, 2002). All of this indicates that the principles of biomechanics have been used to extract teeth for thousands of years. Recently, Physics Forceps was developed by Golden in 2004 and has been modified further with the aid of various researchers (Misch, 2008). Implementation of a first-class lever, creep, and the type of force provides the mechanical advantages necessary to make this dental extraction device more efficient.

**Different designs of physics forceps**

**Standard Series (GMX 100/200)(Fig.1)**

1. **This is a set 4 forceps which includes**
   - Upper Right – Teeth #2-5
   - Upper Left – Teeth #12-15
   - Upper Anterior – Teeth #6-11
   - Lower Universal – Teeth #18-31

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1. **Molar Series (GMX 400)(Fig.2)**
2. **Pedodontic Series (GMX 50)(Fig.3)**

The Pedodontic set of Physics Forceps is designed specifically for use on deciduous (primary) teeth. This set of forceps are similar to the Standard set of Physics Forceps, but they are much smaller (approximately 30%) and are designed for use on deciduous teeth.

**BIOMECHANICS OF PHYSICS FORCEPS**

The Physics Forceps uses first-class lever mechanics. One handle of the device is connected to a "bumper," which acts as a fulcrum during the extraction. The beak of the extractor is positioned most often on the lingual or palatal root of the tooth and into the gingival sulcus. The bumper is most often placed on the facial aspect of the dental alveolus, typically at the mucogingival junction. No squeezing pressure is applied to the handles or to the tooth. Instead, the handles (once in position) are rotated as one unit for a few degrees, and then the action is stopped for approximately 1 minute. The torque force generated on the tooth, periodontal ligament, and bone is related to the length of the handle to the bumper (8 cm), divided by the distance from the bumper to the forceps beak (1 cm). As a result, a force on the handle connected to the bumper will increase the force on the tooth, periodontal ligament, and bone by 8 times. No force is required to be placed on the beak, which is only on the lingual aspect of the tooth root. Therefore, the tooth does not split, crush or fracture.

**Figure 1. Standard Series**


**Figure 2. Molar Series**

**Figure 3. Pedo Series**

## Creep

It is a phenomenon whereby a material continues to change shape over time under a constant load. In a tooth extraction, creep may occur in bone and the periodontal ligament. Reilly established the creep curve of bone, whereby under a constant load of 60 Mpa, the bone over time changes shape (strain) in 3 different stages (Reilly and Burstein, 1975). The majority of bone changes occur within the first minute, whereby the strain of bone (the change of length divided by the original length) is modified. The higher the force that is applied, the greater the deformation of the bone. This process allows the tooth socket to expand and permits the tooth to exit the socket. A secondary creep action occurs over time and allows the bone to further deform when the force is applied during a 1- to 5-minute period. The longer the time, the greater the deformation; however, it expresses only a 10% to 20% difference compared to the initial one-minute strain. Eventually, the third phase of the curve causes the bone to fracture if the load is applied over a long time frame, representing creep rupture. A similar phenomenon occurs in the periodontal complex (Jonsdottir *et al.,* 2006; Andersen *et al.,* 1991). Mechanical forces shift lateral force to a tooth, causing primary movement to the periodontal ligament and space. A greater force over time causes a slight additional tooth movement. Therefore, the creep of the periodontal complex is similar to the creep of the bone, whereby the constant load weakens the periodontal ligament. Thus, a constant load on the tooth over time increases the tooth socket dimension and decreases the strength of the periodontal complex.

Once creep has expanded and weakened the periodontal ligament and bone, the handle of the extraction device may be slowly rotated another few degrees for 10 to 30 seconds. This action contributes to the creep rupture of the ligament and usually elevates the tooth a few millimeters from the socket. At this point the tooth is loose and ready to be removed from the socket using any pincer-like device, ie, pickups, extraction forceps, or hemostats. The extraction of a tooth using the 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 beaks 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 handle magnifies the force by the length of the handle, and the nail is elevated from the wood. Unlike a nail in wood with parallel sides and friction along its full length, a tooth is tapered. After being elevated a few millimeters, the periodontal ligament fibers are broken and the tooth may then be easily removed without additional rotational force. This is important to note, since further rotational force on the tooth may fracture the facial plate of bone.

## Stress

It is the internal distribution of force per unit area that balances and reacts to external loads applied to a body. Stress can be broken down into its shear, tensile, and compressive components. Materials in general are weakest to shear forces and strongest to compressive loads. For example, bone is strongest to force in compression, 30% weaker to tension, and 65% weaker to shear forces.[5]When a rotating force is applied to the Physics Forceps on a tooth, the stress to the tooth and the periodontal complex is a shear component of force. The force applied to the gums and bone by the bumper of the Physics Forceps is over a greater surface area and is a compressive force, thus bracing the buccal bone. This permits the lingual plate to expand more and protects the facial plate from fracture.

## LITERATURE REVIEW

HS Patel et al 2016 in a split mouth clinical study compared the efficacy of physics forceps with conventional forces in terms of operating time, prevention of marginal bone loss & soft tissue loss, postoperative pain and postoperative complications following bilateral premolar extractions for orthodontic purpose and found that physics forceps was more efficient in reducing operating time and prevention of marginal bone loss & soft tissue loss when compared to conventional forces in orthodontic ally indicated premolar extractions. El-Kenawy and Ahmed (2015) in a clinical study evaluated the efficacy of physics forceps versus conventional forces in simple dental extraction and suggested that physics forceps provides ease in difficult extractions, with predictable results, and without need to reflect a flap. Also, it decreases the incidence of crown, root, and buccal bone plate fractures, in comparison to the conventional forces. Hariharan *et al.* (2014) in a randomized controlled clinical trial compared various variables like operative complications, inflammatory complications, and operating time in patients treated by orthodontic extraction of upper premolars with the Physics forceps with the universal extraction forceps and found out that patients treated with Physics forceps had lower pain on the first postoperative day compared to other forceps used.

**Summary and Conclusion**

Biomechanical aspects of force have been applied to tooth extraction for centuries. However, the mechanical advantages available to extract the teeth were primarily applied to hold the crown of the tooth, rather than help extract it. Physics Forceps has been developed to apply a biomechanical rationale to the extraction process of a tooth using a class 1 lever, creep, and shear components of force. The dentist requires some practice before achieving complete mastery in the use of the physics forceps because the technique is significantly different from what is used for conventional forceps extractions; however, once comfortable, the clinician will marvel at the ease and the little force required to remove even difficult teeth.

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