Oral surgery

TYPES OF DENTAL FORCEPS

THE FORCEPS FOR UPPER TEETH

1- The upper straight forceps:-

The blades, joint and handle are in one long straight line. We have two types, one with broad blades that is we call heavy blades and this is used for extraction of upper central incisors and upper canines, left and right.

The second type of straight forceps has narrow blades or we call it fine blades for extraction of upper lateral incisors (left and right) and upper anterior retained roots.

2- The upper premolar forceps:-

Here we have two bends in the design of the forceps, one where the beaks (blades) bend in relation to the joint of the forceps to apply the forceps parallel to long axis of premolar, the 2nd bend or curvature is of the handle to avoid injury to the lower lip and apposing teeth (mandibular). The upper premolars teeth has either one root or two roots (one buccal and one palatal), so there is no difference in the anatomy of the tooth root of the premolar on the buccal and palatal surface so the two blades of the premolars forceps are mirror image to each other.

3- The upper molar forceps (full crown upper molar forceps):-

Since upper molar teeth have three roots, two buccal and one palatal, the blade of palatal side is round to conform or fit on palatal root, while blades on buccal has pointed tip or projection so it can enter or fit the bifurcation between the two buccal roots (mesial and distal) on the buccal side of the tooth. So we have two forceps; one for the right molars and one for the left molars and these forceps also double bend for the same requirement as mentioned for premolar teeth.

The Bayonet forceps, the blades of the forceps are off set to the long axis of the handles, used for extraction of upper 3rd molars right and left. In addition, there is another bayonet with fine curved blades for extraction of upper posterior roots.

Bayonet forceps for crowned maxillary 3rd molars

THE FORCEPS OF LOWER TEETH;-

Here we have the long axis of the blades is in right angle to the long axis of the handle so the blades can be applied apical to the cemento-enamel junction (on the root) of the tooth surface parallel to the long axis of the tooth and the handle not to cause injury to the upper lip. The forceps for the lower teeth are:-

1- Forceps for extraction of lower central and lateral incisors and canine:-

We have fine blades for extraction of the lower central and lateral incisors and lower anterior retained roots which have fine roots with flattened sides (mesiodistally) and heavy blades used for extraction of canines.

2- Premolar forceps:-

Because the bucco-lingual width of the crown in the premolar teeth is larger than that of lower incisors and canines we use forceps with heavy blades but partially away from each other when close to accommodate the crowns of these teeth without crushing for the crown.

Lower premolar tooth forceps Lower molar tooth forceps

3- Full crown lower molar forceps: -

Since the lower molar teeth have two roots, one mesial and one distal root so the buccal and lingual blades of the forceps designed with projected tapered tip to fit the bifurcation of these teeth on the buccal and lingual sides, so the buccal and lingual blades are identical so the same forceps can be used on the right and left sides on opposite to that in upper molar teeth.

In addition to that we have two Bayonet forceps for lower 3rd molars; one for left side and the other for right side.

Mechanical principles of extraction:-

The removal of teeth from the alveolar process employs the use of the following mechanical principles:-

I- Expansion of the bony socket:-

This is achieved by using the tooth itself as a dilating instrument, and this is the most important factor in forceps extraction, and this principle need:-

1- Sufficient tooth substance be present to be firmly grasped by the forceps.

2- The root pattern of the tooth in such that it is possible to dilate the socket to permit the complete dislocation of the tooth from its socket, e.g. dilacerated, divergent, converge roots.

3- Nature of the bone, elastic bone especially in young patients is maximal and decreased with age, older patients usually have denser, more highly calcified bone that is less likely to provide adequate expansion during extraction of the teeth.

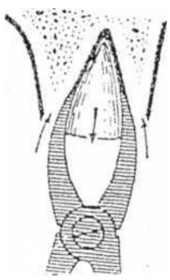
4- Thickness of the bone. Thick bone expansion is less likely to occur by using normal force.

II- The use of a lever and fulcrum

This is used to force a tooth or root out of the socket along the path of least resistance and the principle is the basic factor governing the use of elevators to extract teeth or roots

III-The insertion of a wedge or wedges:-

Between the tooth-root and the bony socket wall, thus causing the tooth to rise in its socket and this explains why some conically rooted mandibular premolar and molars sometimes shoot out of their socket when forceps blades are applied to it.



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 and stabilizes the beak during wrist movements. The beak of the extractor is positioned most often on the lingual or palatal root of the tooth and into the gingival sulcus

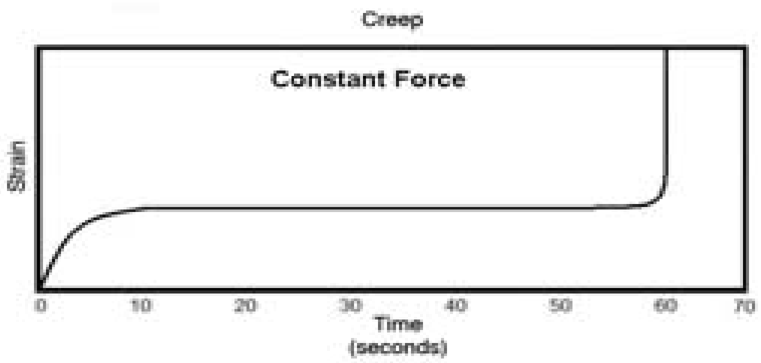
Standard Physics forceps set.

Bumper guards

The bumper is most often placed on the facial aspect of the dental alveolus, typically at the mucogingival junction. Unlike conventional forceps, only one point of contact is made on the tooth being extracted. 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.

Moment of force in physics represents the magnitude of force applied to a rotational system at a distance from the axis of rotation. The principle of moment is derived from Archimedes' operating principles of the lever and is defined as M=rF, where "F" is the applied force and "r" is the distance from the applied force to the object. This is referred to as the moment arm. The length of the moment arm (or lever arm) is the key to the operation of the lever, pulley, and most other simple machines capable of generating mechanical advantage. This means that if the force applied to generate work cannot be increased, it is still possible to gain a greater amount of work by increasing the moment arm of the lever.

"Creep" 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



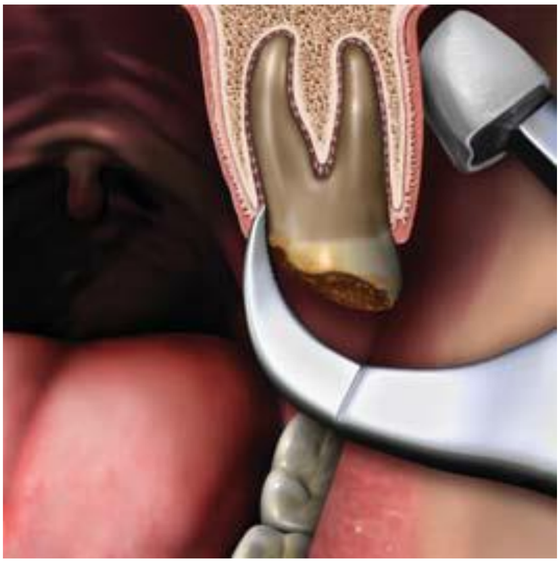
A creep curve demonstrates that a constant force applied to bone or a periodontal ligament results in initial changes in shape, with a prolonged period (horizontal line) necessary before the material fractures or releases (the vertical aspect of the line on the right at 60 seconds).

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.

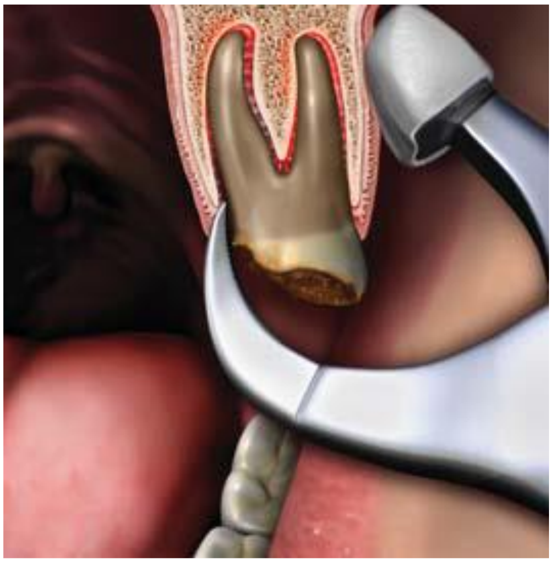
A secondary creep action occurs over time and allows the bone to further deform when the force is applied during a 1- to 5-minute period. The longer the time, the greater the deformation; however, it expresses only a 10% to 20% difference compared to the initial one-minute strain. Eventually, the third 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.

Mechanical forces shift lateral force to a tooth, causing primary movement to the periodontal ligament and space. A greater force overtime 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.

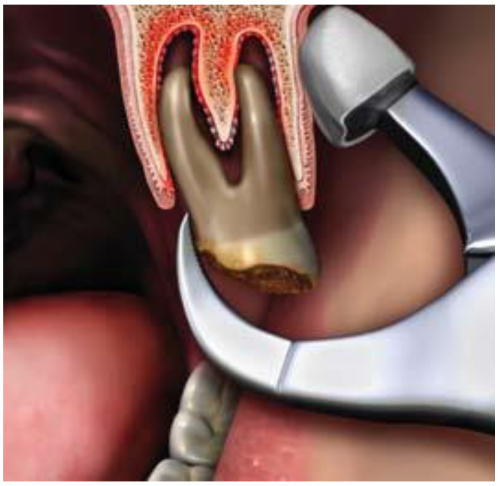
Once creep has expanded and weakened the periodontal ligament and bone, the handle of the extraction device may be slowly rotated another few degrees for 10 to 30 seconds. This action contributes to the creep rupture of the ligament and usually elevates the tooth a few millimeters from the socket. At this point the tooth is loose and ready to be removed from the socket using any pincer-like device, i.e, pickups, extraction forceps, or hemostats.



The Physics Forceps is in position, and constant pressure is applied.



Creep is expanding the bone and rupturing the periodontal ligament.



The tooth is rotated slightly and elevated from the socket.

The tooth was delivered from the socket with a pincer-type instrument as the Physics Forceps are not designed to remove the tooth all the way from the socket but simply to elevate the tooth or release the periodontal ligaments.

The tooth was easily removed from the socket.

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 (Figures below). 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.

A “traditional” dental forceps removes a tooth similar to how a pair of pliers removes a nail.

A claw hammer uses class I lever mechanics, with the handle one lever, the head of the hammer as the fulcrum, and the claw as the short lever applied to the nail. The Physics Forceps uses a similar action to remove a tooth.

Stress 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 ***(Reilly DT., 1975)***. 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.

The instrument is uniquely designed to allow tension to be placed of the periodontal ligament and to achieve excellent leverage. This tension results in the physiologic release of an enzyme by the body that breaks down the periodontal ligament over a short period of time which is called hyaluronidase (hyluronate glycanohydrolase). This is an enzyme that catalyzes the hydrolysis of the interstitial barrier, hyaluronan (hyaluronic acid), which is the cement substance (extracellular matrix) of all human tissues ***(KUMAR DM., 2015)***. This process may take 20 seconds or up to 4 minutes depending on the tooth and surrounding bone structure of the patient. The clinician must be patient, as the technique will feel like nothing is happening since none of the usual operator movements are employed. With the breakdown of the periodontal ligament, the tooth will release or "pop" out of the socket in an upward and outward motion, mirroring the arch form of the head of the instrument. This innovative instrument allows tooth dislodgment with little or no pressure, simply utilizing leverage. The handles are never squeezed like a conventional forceps; rather they are held lightly in the hand, and the wrist is rotated to simply create tension on the palatal aspect of the root. There is no forearm, bicep, or shoulder pressure used. The handles simply allow the beak to engage the root structure without slipping off. During a short time of constant tension, the root will disengage or pop from the socket incisally and facially. Although the facial bone may expand slightly, the movement of the tooth out of the socket is not straight facial, but rather up and out of the socket. This allows for maintenance of the facial plate of bone, when the instrument is used correctly. One of the biggest misconceptions of this innovative technique is that it is a "forceps" as the names implies, when it fact it is a lingual elevator ***(Kosinski T, Golden R., 2015).***

Atraumatic extraction with the Physics Forceps (Golden Dental Solutions). Using the proper hand position and hold are a must when utilizing the Physics Forceps technique.