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Latest trends in atraumatic extraction of teeth

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Abstract
Ridge preservation is crucial in any extraction situation, especially if the site is planned for a future dental implant. Atraumatic extraction and socket management will lead to a predictable foundation for future treatment. Traditionally, conventional forceps along with elevators have been used in the extraction process. With forceps, the tooth is usually rotated in a buccal-lingual direction, which may result in weakening or fracturing of the buccal or lingual plate. An elevator is most commonly inserted mesially or distally with a leveraging or wedging force, which also may traumatize the hard and soft tissue. The basic process of atraumatic tooth extraction and preservation of soft and hard tissues begins with four generalized principles that should be applied to all extractions. By following atraumatic extraction technique, the quantity and quality of bone will be preserved, along with the gingival architecture. This will ultimately lead to more predictable implant positioning and placement. By adhering to the basic principles of atraumatic extractions and the use of atraumatic extraction kit rather than the use of periotome is a more predictable healing pattern may be obtained, as the vitality of the periodontal ligament and the surrounding blood supply is maintained.

Keywords: Body's bone, teeth, dental implant

Introduction
To maximize the body's bone healing and regeneration process, the clinician must have a thorough understanding of several key points, including how to maintain hard and soft tissue after an extraction. It is imperative today that the clinician understands the consequences of tooth extraction relating to the hard and soft tissues. It has become the standard of care to preserve these tissues whenever possible for long-term oral health, function and esthetics. Ridge preservation is crucial in any extraction situation, especially if the site is planned for a future dental implant. Atraumatic extraction and socket management will lead to a predictable foundation for future treatment.

The wound healing process includes a complicated cascade of biochemical and histologic events. A systemic review of extraction site remodeling has shown that the alveolar ridge undergoes on average a horizontal loss in width of 3.8 mm and a vertical reduction in height of 1.24 mm during the six months after extraction.1 Following extraction, the buccal plate exhibits a greater degree of bone resorption in comparison to the lingual plate, which results in an alteration of the position of the residual ridge. This may adversely affect implant positioning, leading to difficulty in successful implant placement and positioning. Therefore, it is imperative that teeth are extracted in an atraumatic manner in order to maximize and maintain the volume of the hard and soft tissues to increase future implant success.

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Theory of atraumatic tooth extraction
One of the most important factors in the successful healing of an extraction site is the atraumatic removal of the existing tooth. The extraction of a tooth can be time-consuming and damaging to the related oral anatomy. Although surgical techniques in the extraction of teeth have evolved over time, very little has changed in the way of instrumentation. Traditionally, conventional forceps along with elevators have been used in the extraction process. With forceps, the tooth is usually rotated in a buccal-lingual direction, which may result in

weakening or fracturing of the buccal or lingual plate. An elevator is most commonly inserted mesially or distally with a leveraging or wedging force, which also may traumatize the hard and soft tissue (Fig. 1).

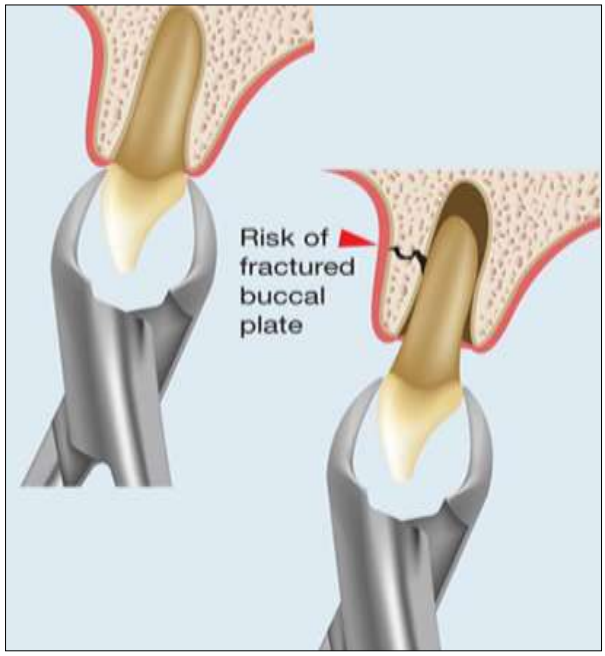

Fig 1: Conventional extraction techniques often result in fracture of the buccal or lingual alveolar plates, which leads to compromised healing.

If the tooth extraction is traumatic, a full array of complications may result, including the loss of a bony wall, disruption of the blood supply, compromised healing, and an increase in inflammation, infection and soft-tissue damage (Figs. 2, 3). Therefore, all teeth indicated for extraction should ideally be removed with care and preservation of the hard and soft tissues.

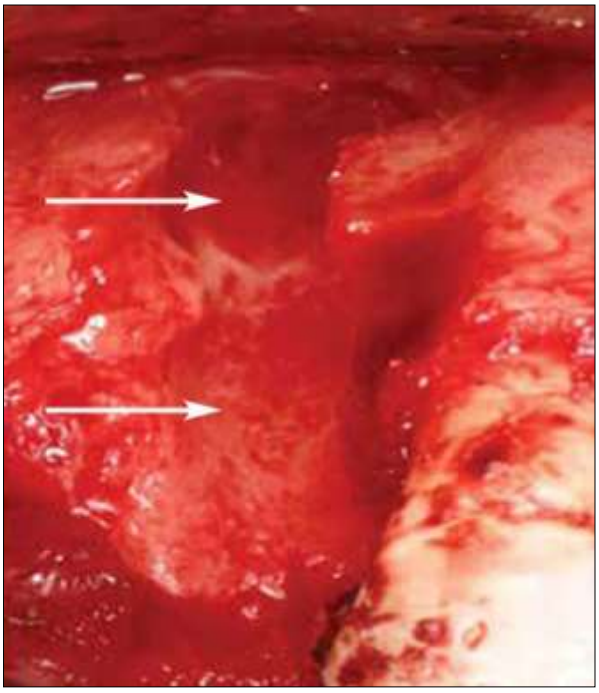

Fig 2: Consequence of buccal plate fracture resulting in a four-wall defect

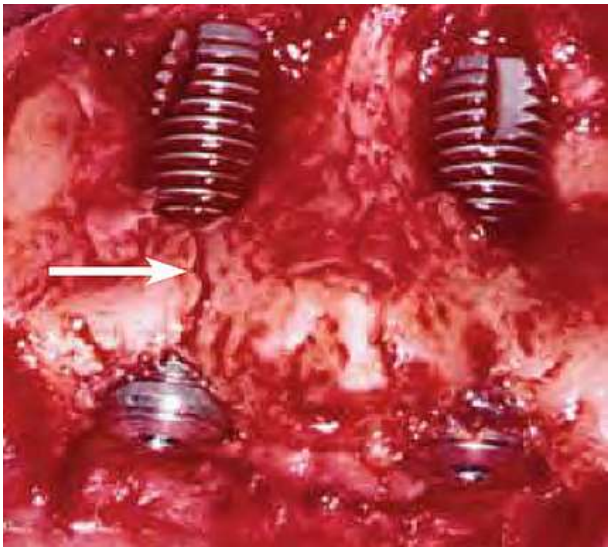

Fig 3: Non-ideal implant placement after traumatic extractions leading to questionable implant prognosis.

The basic process of atraumatic tooth extraction and preservation of soft and hard tissues begins with four generalized principles that should be applied to all extractions.

1. Sever the connective-tissue fibers

The first step in the atraumatic removal of a tooth is to completely sever the connective tissue fibers by incising circumferentially around the tooth. There exist 13 different connective tissue fiber groups surrounding a tooth, of which six — known as Sharpey's fibers — directly insert into the cementum of the tooth and the alveolar bone. If these fibers are not severed or cut prior to the extraction, trauma to the soft tissue is likely to occur. Vigorously tearing these connective tissue fibers may lead to increased bleeding, delayed healing, increased postoperative discomfort, and alteration of the bundle bone surrounding the extraction. The periodontal ligament fibers can be severed with the use of a No. 15c surgical blade or thin periotome instruments.

2. Minimize soft-tissue reflection

The soft-tissue drape surrounding the teeth is directly affected by the reflection of the periosteum and often recedes to adapt to the residual ridge form. The soft tissue is more vulnerable to surgical trauma and reflection than are the hard tissues. The sulcular and surrounding soft tissue should ideally remain undisturbed during tooth extraction to prevent further dimensional loss. Therefore, the soft tissue should not be reflected, if possible, as doing so increases the likelihood of soft-tissue retraction and shrinkage during the initial healing, especially in the interdental papilla region.

Usually a flap is raised when the buccal plate is not intact or surgical extraction of the tooth is indicated. If a tissue flap needs to be raised, an envelope flap, which includes no vertical extension, is recommended. Vertical incisions may compromise the blood supply and delay healing of the area. Whenever the periosteum is reflected, cells are injured and need to regenerate before the remodeling process begins. The cortical bone receives more than 80 percent of its arterial blood supply and facilitates 100 percent of its venous blood return through the periosteum.2 in some situations, reflection of the tissue is necessary and should therefore be as conservative as possible (Figs. 4, 5).

Fig 4: Soft-tissue reflection for tooth extraction: ideal technique including no soft-tissue reflection for a tooth extraction

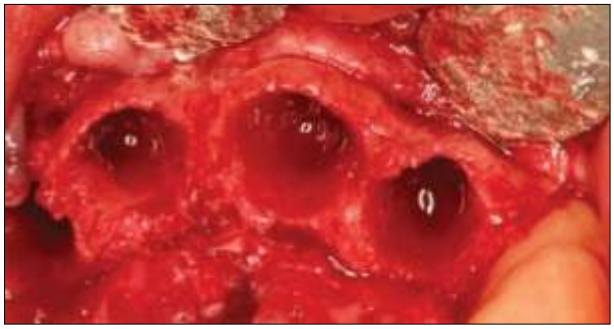

Fig 5: Non-ideal technique including extensive reflection of the soft tissue, which results in compromised blood supply

3. Reduce contact areas

The pathway of tooth removal can be obstructed by the position of adjacent teeth at the extraction site. If the mesial and distal surfaces of the tooth to be extracted are not reduced, instruments or pressure may chip the enamel or restoration of the adjacent tooth during extraction and may alter the pathway of removal, which is more likely to fracture the roots, bone or both. To minimize damage to the hard and soft tissue, reduce the contact areas of the tooth to be extracted (Fig. 6). This will allow the tooth to be loosened, thereby enabling an easier, less traumatic path of tooth removal.

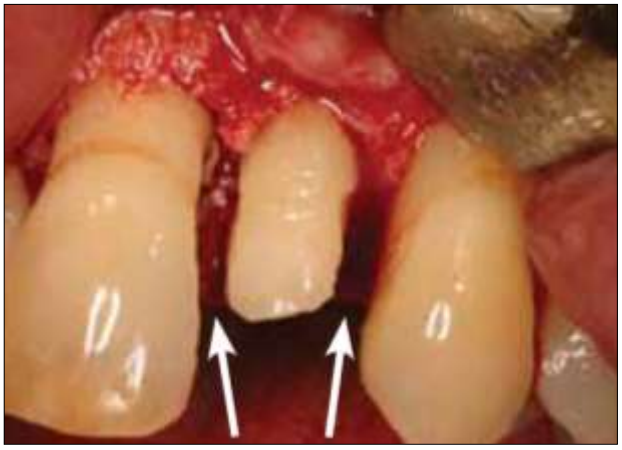

Fig 6: Clinical example of contact areas being removed on a maxillary lateral incisor to allow for less traumatic tooth extraction

4. Use of conventional forceps

In some situations, the tooth will be mobile and may need to be removed with traditional dental forceps. The extraction forceps should not be applied to the tooth until significant tooth mobility is present, thereby preserving the buccal plate. Once significant mobility exists, the dental forceps are used to ultimately grasp and deliberately rock the tooth back and forth until the tooth is easily removed from the socket.

5. Atraumatic extraction protocol

5.1 Periotome technique

Fig 7: Periotomes are available with various tips to aid in atraumatic extraction

1. The long axis of the periotome blade should be inserted into the interproximal region along the long axis of the root, which protects the facial plate of bone, with the tip of the periotome blade located within the crest of the alveolar bone (Fig. 8).

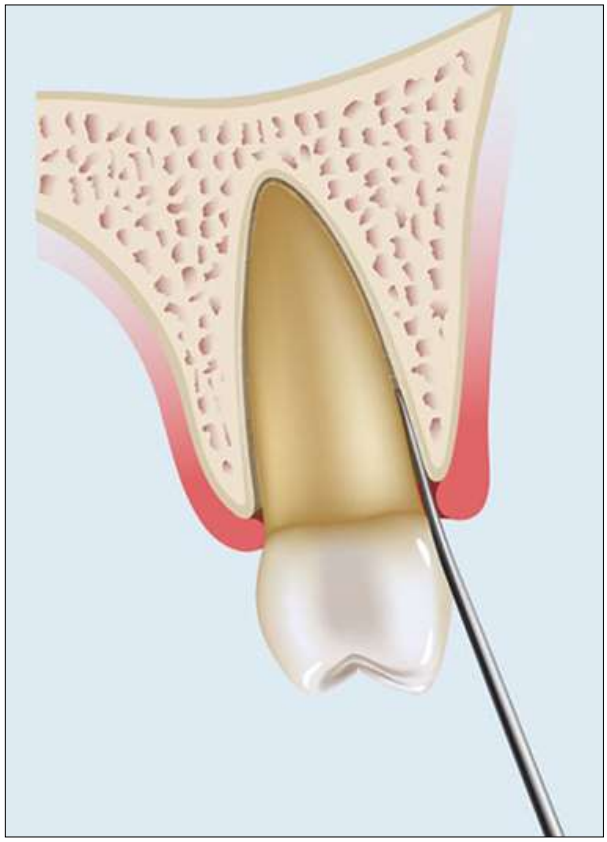

Fig 8: Use of periotome

The instrument is then pushed deeper into the periodontal ligament space or tapped with a mallet into the space along the mesial and distal root, severing the periodontal ligament immediately below the alveolar crest and wedging the tooth against the opposing cribriform plate (Fig. 9). The periotome should never be used on the facial plate, as this may damage the facial bone, which is typically thin.

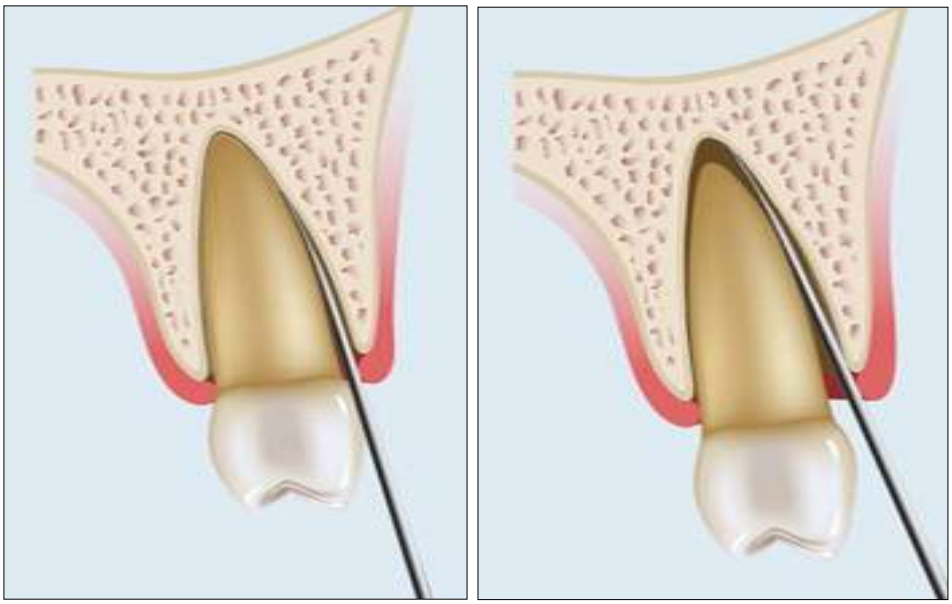

Fig 9-10: Periotome technique: The periotome is inserted along the long axis of the tooth (8, 9); as the periotome is inserted more apically, the tooth will become loose and slowly avulse (10).

2. A period of 10–20 seconds is allowed to elapse while the instrument is in place. This allows biomechanical creep to occur to the bone and periodontal ligament. Creep is defined as a phenomenon in which a material continues to change shape over time when a constant force is applied. As the tooth is pushed against the opposing alveolus, it will begin to expand the bone and allow the tooth to exit the socket. This process is much more effective when there is no adjacent tooth contact.
3. The periotome is then gently pushed farther down into the periodontal ligament space toward the root apex, often using a mallet and light tapping force. This process continues along the crestal one third of the tooth. At the completion of this procedure, the tooth is often slightly mobile.
4. The periotome may then be converted to a lever. The blade of the periotome is typically 3–4 mm wide. When the handle is slightly rotated, one side of the periotome is applied to the tooth root and the other side to the cribriform plate. The width of the "wedge" is now the length of a lever, which magnifies the rotation force (moment). The rotation of the periotome handle increases both tooth mobility and the force against the opposite cortical plate to further expand it within physiologic limits. Care should be exercised to use slow, gentle pressure to minimize the possibility of fracturing the periotome tip.
5. Because most tooth sockets are tapered, the lateral force on one side of the tooth is converted to a coronal direction force on the other side, and the root will begin to avulse out of the socket. The periotome is pushed farther apically, toward the root apex, as the mobility increases (Fig. 10). Additional time and elevation may be required if significant tooth mobility is not achieved.

6. Atraumatic extraction by using atraumatic extraction kit (COWELMEDI)

Atraumatic Extraction Kit is used for the immediate and effortless extraction of a tooth with simple procedures according to the type of tooth (e.g., root, apex, and molar) and its position (e.g., mesial and distal). This can also be applied to various cases. A tooth extraction without the risk of directly damaging the tooth is possible by using the rest plate, elevator, etc. A very simple and convenient tooth extraction is possible, as compared to the existing methods. (Figure 11)

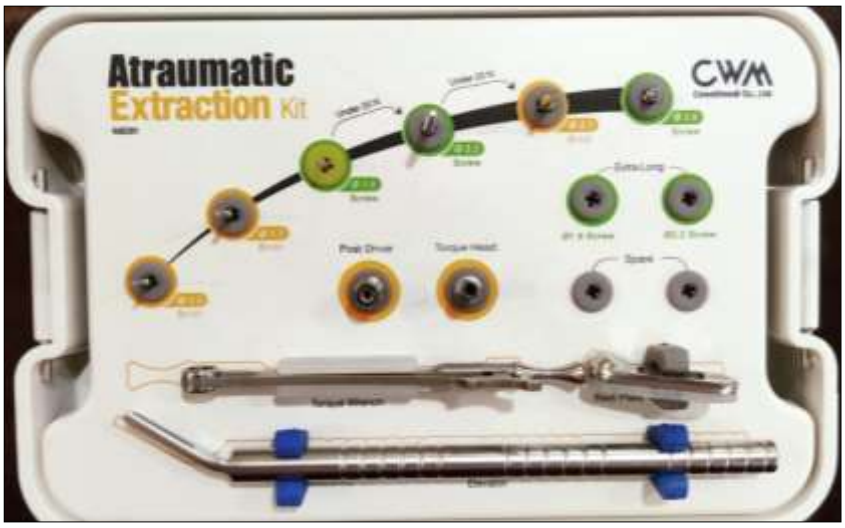

Fig 11: Atraumatic extraction kit

1. All the coronal structure of tooth is removed by grinding the tooth and is smoothened A hole is created on the tooth to be extracted by using the extraction drill. The Extraction Drill must follow the root canal during drilling. It is drilled down to at least 10mm because extraction is possible even if the drill and screw penetrate the root.

Fig 12: Hole is drilled into root

After connecting the extraction screw to the post driver, it is turned clockwise in order to fix it to the hole that was created. (Recommended torque: 30 N/cm or more) The extraction screw is fastened into the hole that was created by the extraction drill via the screw method, and it is stably fixed to the remaining tooth the extraction screw position can be set according to the distal and mesial directions of the adjacent teeth and the position of the tooth to be extracted. (Figure 13)

Fig 13: Extraction screw is connected to screw driver

2. Torque Head is connected to Screw Extraction Root After considering the adjacent teeth, extraction screw is inserted into the rest position hole (Figure 14)

Fig 14: Torque head is placed on the rest plate

3. After connecting the post driver to the extraction screw, turn the torque wrench in a clockwise direction in order to fix it to the hole that was created by the extraction drill.
4. The rest plate is connected between the extraction screw and the torque head. It protects the part with silicon that comes into direct contact with the adjacent teeth in order to prevent tooth damage (Figure 14). It also serves as a support for the elevator and torque wrench. - One side is inclined at a 30-degree angle, so that it can act as a support depending on the removal direction. - The holes are created at a 5-mm interval in order to adjust the position of the extraction screw according to the position and distance of the adjacent tooth.
5. Then elevator is used by connecting it with the torque head and extracting the tooth by applying force toward a distal or mesial direction. When extracting a tooth by supporting the distal or mesial tooth
6. Alternatively Torque head can be rotated clockwise by using torque wrench to extract the root (Figure 15)

Fig 15: Rotation of torque head with wrench cause extraction of root

Summary
The atraumatic extraction technique is a crucial component of the ridge preservation process. By following this technique, the quantity and quality of bone will be preserved, along with the gingival architecture. This will ultimately lead to more predictable implant positioning and placement. By adhering to the basic principles of atraumatic extractions and the use of atraumatic extraction kit rather than the use of periotome is a more predictable healing pattern may be obtained, as the vitality of the periodontal ligament and the surrounding blood supply is maintained.

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