

# Masterclass in Clinical Practice

## Implant Dentistry with

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## Minimally Invasive or Low Trauma extraction techniques

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### Introduction

Implant placement after the loss of teeth has become a standard procedure. Low trauma removal of teeth is an essential skill for clinicians wanting to do implant placement afterwards. It is often erroneously called atraumatic extraction. No extraction can be atraumatic, and this term should not be used.

Although these techniques were developed because of the need to preserve alveolar bone for immediate or delayed implant placement, it should be our aim for all extractions. After all, why would anyone perform an extraction where unnecessary damage is done to the alveolus?

Most implant patients are older persons, and with age the coronal alveolar bone volume decreases.<sup>1</sup> This further emphasizes the need for low trauma extraction, to preserve what little bone there is. Low trauma extraction does not guarantee the preservation of the alveolar bone, as the thickness of the socket walls will determine the amount of resorption after removal of a tooth. A thick socket wall is regarded as one of more than 1mm.<sup>1</sup> Less than this and most of the socket wall will disappear as it will consist of bundle bone only. Bundle bone is a tooth related structure and will resorb after loss of a tooth. This resorption will occur within 4-8 weeks after tooth extraction.<sup>1</sup> If the socket walls are to be used to contain bone filler material as a barrier against soft tissue invasion in ridge augmentation, the implant should be placed immediately or delayed for 2-4 weeks if acute infection at time of tooth removal prevents immediate placement. Once the socket wall has resorbed, contour augmentation becomes a more challenging procedure (see figure 1). Contour augmentation will support aesthetic soft



*Figure 1: Loss of complete facial wall requires extensive augmentation for implant placement and is a complex procedure.*

tissue contours and provide the recommended minimum of 2mm bone wall thickness around a dental implant.<sup>1</sup>

To perform a low trauma extraction, one must have an intimate knowledge of the anatomy of not only every tooth, but also the alveolar bone and tooth socket. Where the bone is thick enough to allow a minimal widening of the socket, it may aid in moving the root as well as gain entry for a root elevator tip. To plan this properly, a CBCT scan has become indispensable.

## Objectives of Low trauma extraction:

### 1. Preserve an intact tooth socket.

This requires the removal of the tooth or root without lifting a flap. Lifting a flap will lead to bone resorption due to the removal of blood supply.<sup>2</sup> In addition, no vertical bone height should be removed in order to extract a root and horizontal bone removal to allow an entry point for a luxator should only be done where the bone width is sufficient. A recent review found that socket seal techniques after root removal may help in preserving socket walls, but more studies are needed to evaluate this.<sup>3</sup> Introducing more procedures to the removal of a root/tooth also defeats the objective of low trauma surgery and increases the cost of an already expensive procedure. The objective is to remove the root or tooth in a flapless manner, without suturing. This will keep the muco-gingival dimensions intact for improved aesthetic outcome and regenerate gingiva across the dimensions of the socket. Adequate gingiva is important in implant stability, and it has been shown that sufficient gingival width and thickness is essential in peri-implant bone stability.<sup>4, 5</sup>

### 2. To benefit immediate or early implant placement with augmentation.

Having an intact socket wall helps to contain any bone filler used in jump-gap augmentation. If no acute infection is present at the time of root removal, immediate implant placement may be considered. In a case where acute infection does exist, careful curettage of the socket can be done with 2-4 weeks of healing allowed to clear any residual infection, before placing an implant. Eight weeks after flapless low trauma removal, the facial socket wall will have undergone significant resorption and the absence of a facial socket wall will increase the complexity of contour augmentation as well as the cost. It will resorb more in thin periodontal phenotype patients and where prior facial wall defects existed.<sup>6</sup> This emphasizes the importance of pre-surgical planning using CBCT to assess the socket wall thickness.

### Technique:

Before attempting any low trauma removal, the anatomy of the root/s should be studied from all viewpoints to determine the thickness of all 4 socket walls, the number of roots, the shape and length of roots and any anatomical complications such as sinus or inferior alveolar nerve involvement. The presence of any pathology around the roots should also be determined. The CBCT should be scrolled through carefully in both axial, cross-sectional and panoramic views. In multiple rooted teeth, the axial slicing will show at what level the roots can be separated for individual low trauma removal of each root. It will also show whether a root is round and therefore

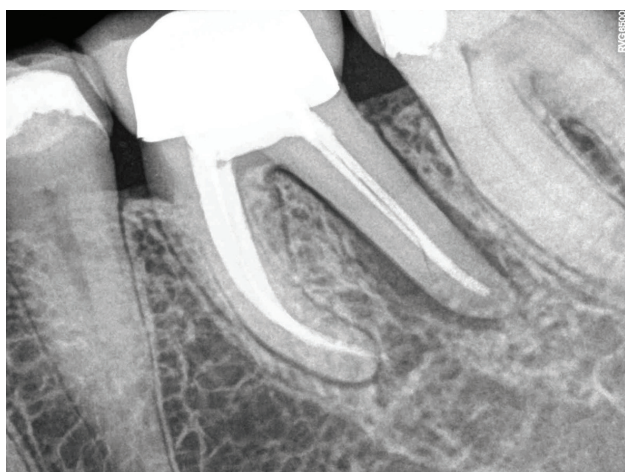
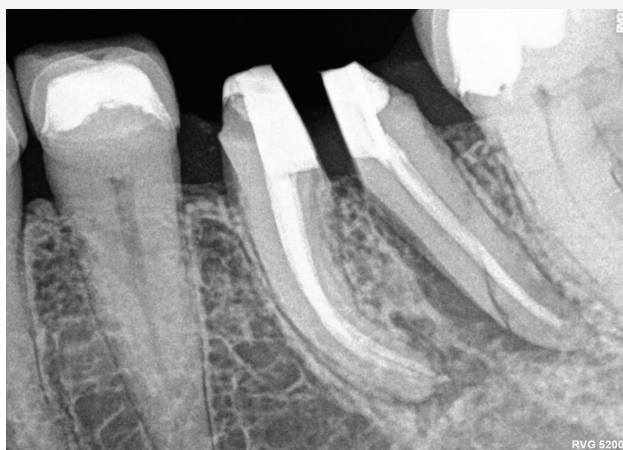


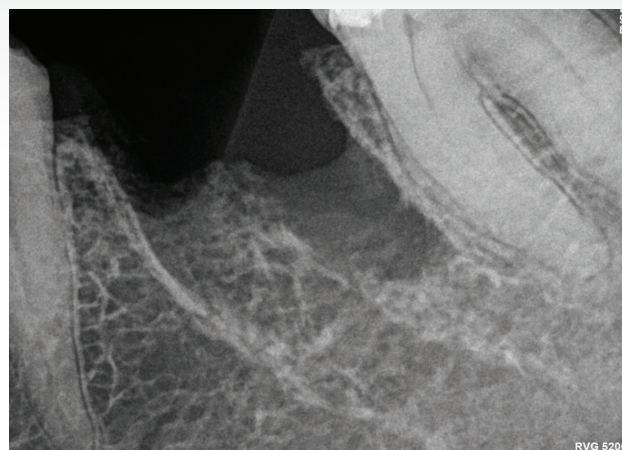
Figure 2: Pre-operative view of tooth 36 showing infection and a fractured root



Figure 3: After removal of the crown of tooth 36, the roots are sectioned through the furcation



**Figure 4:** Radiograph showing sectioning without removal of interradicular bone



**Figure 5:** Post-operative view showing removal of tooth and no debris remaining in socket.

possible to rotate, versus a more difficult triangular or figure eight root shape. Axial slicing will also show the volume of interdental and interradicular bone which will determine if a purchase point may be prepared for root luxators, without harming the tooth supporting bone needed for the implant/augmentation (see case presentation below of removal of root 13). By removing each root individually, the interradicular bone can often be preserved, adding to the total bone volume for socket healing. Splitting a mandibular molar is easier than a maxillary molar, as not only does it have two roots instead of three but removing a small section of the interradicular bone is much easier and will ease the elevation of the two roots. Figures 2-5 show sequential

images to demonstrate the low trauma removal of tooth 36. The worst-case scenario in difficult multi-rooted tooth removal, is to remove bigger sections of the interradicular bone rather than to harm the facial or palatal socket walls. This will still leave a confined bony defect surrounded by 4 bony walls, even if all the interradicular bone is removed. It can therefore only heal with bone, even though it may take longer than if the interradicular bone was left intact.

## Instrumentation:

### 1. Periostomes

Periostomes are fine tipped instruments to sever the dento-gingival fibres as well as the most coronal periodontal ligament fibres.

### 2. Root luxators

Each clinician will have their favourite root luxators, but Coupland numbers 1-3 will take care of most situations. The elevator is inserted into the coronal portion of the periodontal ligament space and using a gentle back-and-forth rotational movement the root is loosened by tearing the periodontal ligament fibres.

### 3. Piezo surgical unit: periostome and saw tips

This is almost indispensable to remove difficult to reach roots, badly decayed roots, or broken root tips. With fibre-optic lighting to aid vision it enables widening of the socket with low trauma by removing bundle bone only.

### 4. Miller socket curettes

After removal of a root, the socket should be curetted down to the most apical section. The curettes should be chosen to match the root tip dimension, thereby ensuring effective debridement. Always confirm that all debris is



**Figure 6:** Benex vertical extraction attached to root 24. The force is distributed to the adjacent healthy teeth. Periostomes should still be used to sever the dental fibres to aid the extraction process.



cleaned out by a post-operative radiograph (Figure 5).

## 5. Benex® extraction system

The Benex® vertical extraction pulley system (Benex, Luzern, Switzerland, <https://www.benex-dent.com>) is one of the lowest trauma techniques to remove a severely broken down/fractured root. It is ideally suited for single rooted teeth in the aesthetic zone.<sup>7</sup> (Figure 6)

## Conclusion

Low trauma extraction should not involve an open flap approach, should not include bone removal with a bur and should ideally not involve suturing other than to stabilise the papillae. If more than Bundle bone needs to be removed it should be limited to interradicular bone in multi-rooted teeth or interdental bone if the interdental space allows it, otherwise it may cause irreversible damage. It requires specialised instruments as listed above. Forceps extraction should not be used other than in a gentle back and forth rotation movement with round roots. Cone beam computed tomography is an essential tool to study the anatomy beforehand, determine the degree of difficulty to be expected and to assess possible anatomic complications. CBCT and specialised instruments are not luxuries, but essentials in limiting trauma to the alveolus and ensure a successful dental implant placement.

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## Case Presentation: Low trauma removal 13

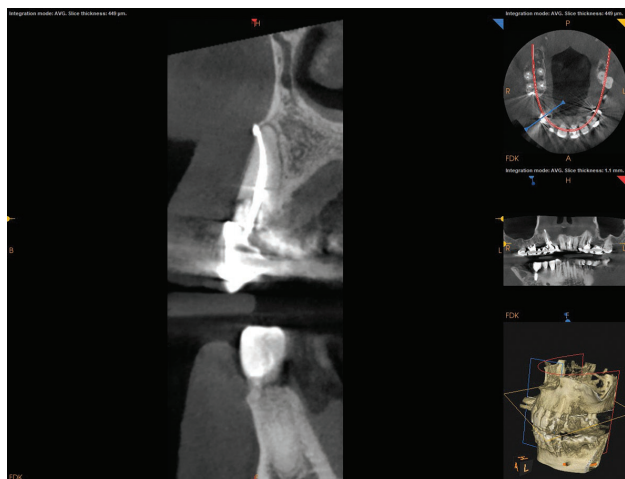


Figure 7: Cross section of failed bridge anchor showing almost no buccal bone volume and thick palatal bone

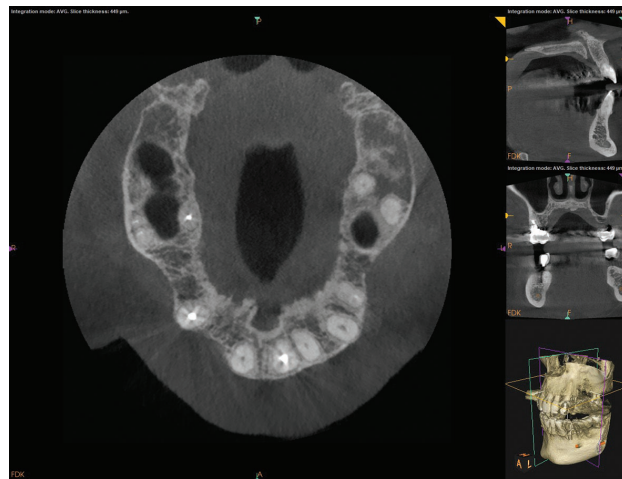


Figure 8: Axial view of 13 showing root prominence and thin facial wall indicating it is Bundle bone only

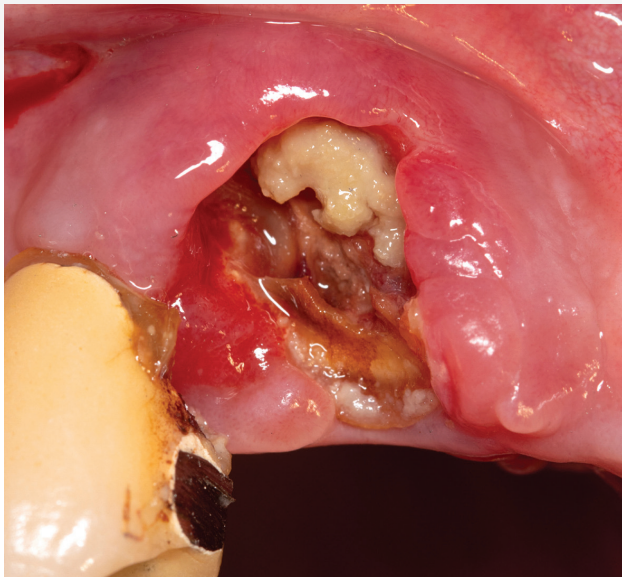


Figure 9: Clinical view with bridge removed showing extensive subgingival caries and soft tissue infection



Figure 10: Root removed in one piece with Miller socket curettes shown adjacent to compare shape and size with root size. If socket curette is too big it will not reach the apical portion of the socket for effective debridement

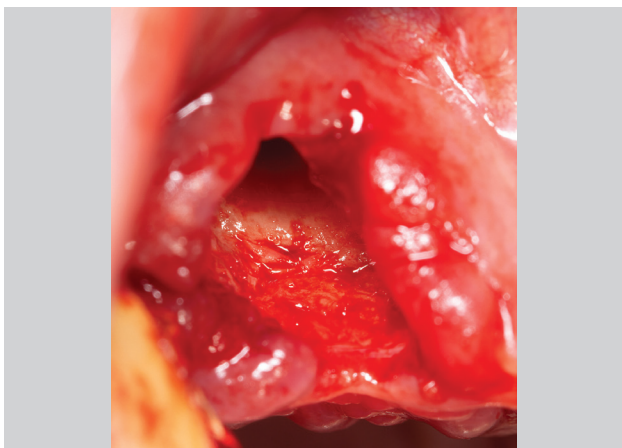


Figure 11: Postoperative view showing intact palatal bone wall

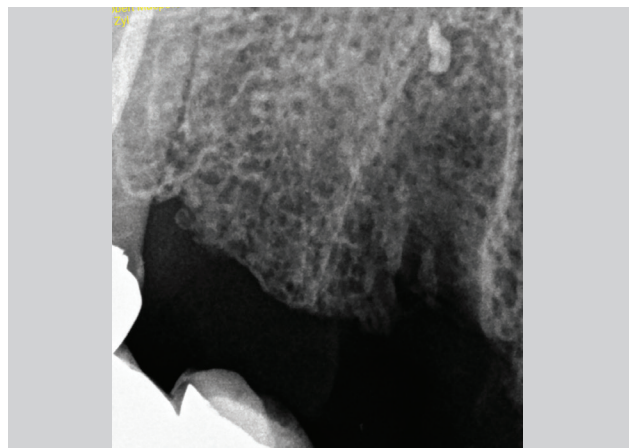


Figure 12: Postoperative view showing residual debris in socket



Figure 13: The preoperative CBCT is used to identify 3D position of debris. Even so it took twenty minutes of careful curettage of the socket before getting the gutta percha out while preventing destruction of buccal bone



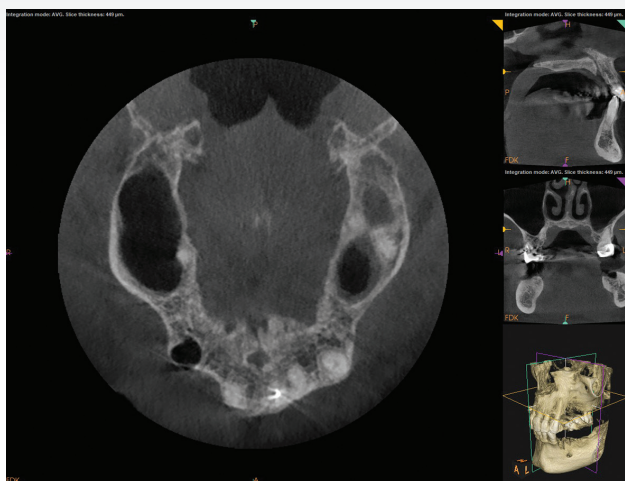


Figure 14: Axial view after removal of root with the purchase point prepared by piezo visible disto-palatal of socket

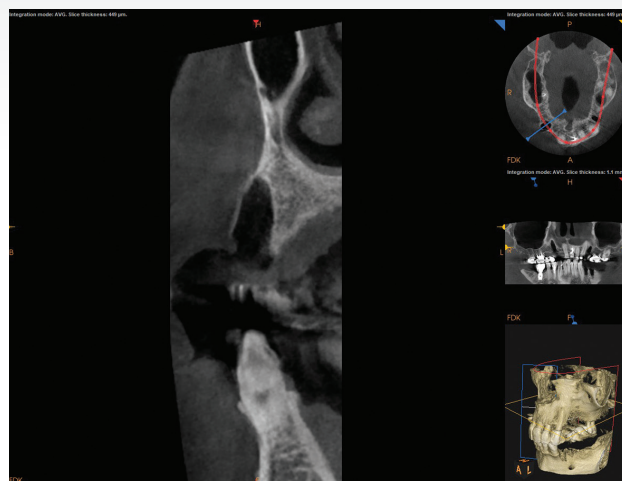


Figure 15: Postoperative cross section view showing intact bone wall after low trauma removal of root, even though the buccal wall is less than 1 mm in thickness.



Figure 16: NSK Variosurg 3 piezo handpiece is equipped with LED light enabling vision in difficult to reach areas and is a low weight handpiece, easy to manoeuvre



Figure 17: The periosteal tip on left (0,7mm thick) and the bone surgery "saw" tip (0,6mm thick) enabling the enlargement of socket by removing bundle bone only



Figure 18: Tooth 16 with periodontal ligament space clearly visible

Figure 19: Periosteal tip inserted within a gingival sulcus will enter the coronal part of the periodontal ligament space. This will sever the dento-gingival fibres as well as the most coronal periodontal ligament fibres

Figure 20: The bone surgery "saw" tip inserted into the periodontal ligament space- showing how it is possible to enlarge the socket or create a purchase point for a root elevator, without removing any tooth supporting bone other than bundle bone. This is possible for interdental and interradicular bone.