

Recording...

# Broken File Removal, Technique and Consideration

Bernard Iskandar  
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 Tunjung Nugrah...  
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 Tri Endra Utara

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see better, do better'  
see better, do better'  
see better, do better'

Bernard Iskandar

ENG 9:09 AM  
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# Broken File : What to do

## Vision - microscope

- Ultrasonic instrumentation

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## Vision-Microscope-Magnification device in the clinical procedure

possibility & ease of removing broken instruments from the canal



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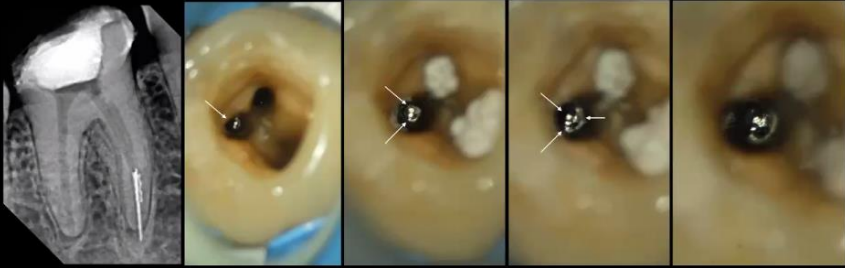
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## Vision-Microscope-Magnification device in the clinical procedure

possibility & ease of removing broken instruments from the canal



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## Ultrasonic Instrumentation



EndoSuccess Retreatment Kit (Ref. F00737):  
supplied with ET18D, ET20, ET25, ET25S, ETBD and ETPR tips,

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# Instrument Separation

- Causes of Instrument Separation
- Conditions for Separated Instrument Removal Attempts
- Management of Separated Instruments
- Separated Instrument Removal Technique
- Prognosis

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Recording... Causes of Instrument Separation

- \* canal curvature (radius),
- \* inadequate access, absence of a glide path
- \* operator experience,
- \* overuse of the instrument,
- \* too much radicular pressure during instrumentation,

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## Causes of Instrument Separation

- \* continuous use of a large instrument in a curved canal.
- \* using the instrument with improper torque/speed
- \* instrument design and technique,
- \* the type of NiTi alloys used,
- \* manufacturing process,



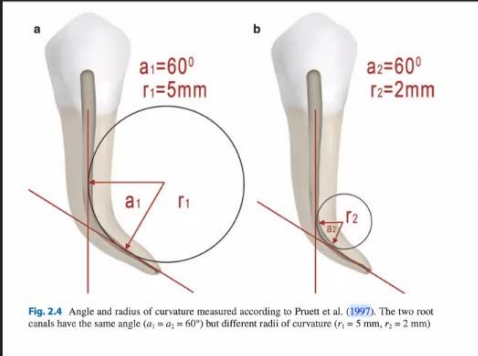
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## The curvature of a root canal - angle and radius

The curvature of a root canal is described by its angle and radius (J Endod. 1997;23(2):77-85.); the wider the angle and the smaller the radius, the more abrupt the curvature.



**Fig. 2.4** Angle and radius of curvature measured according to Pruett et al. (1997). The two root canals have the same angle ( $a_1 = a_2 = 60^\circ$ ) but different radii of curvature ( $r_1 = 5 \text{ mm}$ ,  $r_2 = 2 \text{ mm}$ )

Pruett JP, Clement DJ, Carnes DL Jr. Cyclic fatigue testing of nickel-titanium endodontic instruments. J Endod. 1997;23(2):77-85.



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**Fig. 2.4** Angle and radius of curvature measured according to Pruett et al. (1997). The two root canals have the same angle ( $\alpha_1 = \alpha_2 = 60^\circ$ ) but different radii of curvature ( $r_1 = 5 \text{ mm}$ ,  $r_2 = 2 \text{ mm}$ )

Even if two canals have the same angle of curvature they may have different radii of curvature, which indicates that some curves are sharper than others *J Endod 2005;31:796-798.*

The radius of curvature is the most significant factor in rotary file failure *J Endod 2003; 29: 55-57.*

That the rate of file separation increases as the radius of curvature decreases *J Endod 2005; 31: 114-116*

1. Pruett JP, Clement DJ, Carnes DL. Cyclic fatigue testing of nickel titanium endodontic instruments. *J Endod 1997;23:77-85.*

2. Schneider SW. A comparison of canal preparations in straight and curved root canals. *Oral Surg Oral Med Oral Pathol 1971;32:271-5.*

(*J Endod 2009;35:1469-1476*)

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# File fracture as a result of

- cyclic fatigue *(J Endod 30:722, 2004)*
- torsional fatigue *(J Endod 26:161, 2000)*
- a combination of both. *(J Endod 26:161, 2000; J Endod 39:133, 2013; J Endod 34:83, 2005)*

Clinically, cyclic fatigue seems to be more prevalent in curved root canals, whereas torsional failure might happen even in a straight canal. *(Int Endod J 38:802, 2005; J Endod 37:382, 2011.)*

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## Recommendations to Minimize the Incidence of Instrument Separation

- Ensure straight-line access and good finger rests.
- Create a glide path and patency with small hand files.
- Use a crown-down shaping technique depending on the instrument system.
- Use a light touch on the instrument; never push hard.
- Files should be used according to the manufacturer's instructions and excessive forces should be avoided.

J. Endod, 32:1031-43, 2006.



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## ACCESS CAVITY



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## Recommendations to Minimize the Incidence of Instrument Separation

- Avoid skip of instrumentation.
- The files used in narrow and curved canals have to be replaced immediately.
- Examine the used files regularly, preferably under magnification.
- Instruments should not be used in dry canals
- Use lubricant (irrigant solution) before instrumentation the canal.
- Avoid keeping the file in one spot, particularly in curved canals.

J. Endod. 32:1031-43, 2006.



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## Incidence of Fractured Instruments

**Incidence rate of fractured hand instruments range between 0.25 and 6% (J Endod. 2006;32(11):1048-52).**

**Fracture incidence is independent of number of uses (J Endod. 2003;29(10):664-6.; Int Endod J. 2004;37(4):249-59.; J Endod. 2006;32(12):1139-41), and due to many factors (Int Endod J. 2004;37(4):249-59.).**

**Most frequently reported in molars (J Endod. 2011;37(6):758-63), and is occurring in the mesial roots of mandibular molars (J Endod. 2003;29(11):756-63).**

**File fracture in the apical area was (J Endod. 2006;32(11):1048-52.; J Endod. 2008;34(6):675-8.; Int Endod J. 2014;47(2):183-90.) 33 x greater compared to the coronal third & 6 x times greater compared to the middle third of the root canal (J Endod. 2006;32(11):1048-52).**



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# Instrument Separation

Causes of Instrument Separation

## Conditions for Separated Instrument Removal Attempts

Management of Separated Instruments

Separated Instrument Removal Technique

Prognosis



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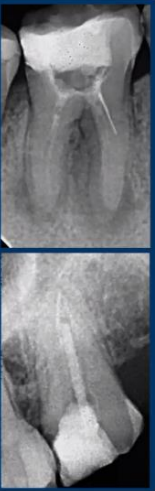
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Analyze the preoperative radiograph and the CBCT, if available, before proceed with the operative phase

- Location and position of the fractured instrument
- Size, type and the length of the fragment
- Anatomical characteristics of the root canal (length, curvatures, wall thickness)
- The possibility of obtaining a straight access to most of the coronal part of the fragment.



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Several factors influence the possible removal of broken instruments from root canals:

I. The root canal anatomy

The possibility of removing or by-passing the fractured instrument depends on:

- The shape and diameter of the root canal
- The presence of curvatures or concavities
- The thickness of the dentin in the area where the fragment is located.

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I. The root canal anatomy

The possibility of removing or by-passing the fractured instrument depends on:

- The shape and diameter of the root canal
- The presence of curvatures or concavities
- The thickness of the dentin in the area where the fragment is located.

The possibility of obtaining a straight access to most of the coronal part of the fragment.

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concavities

concavities

CT Scan Slices

Buccal

danger zone

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### Location of the file

3121\*(9)-16nf

3078\*(9)-46NF

2866\*(9)-17R

- Coronal portion, and there is a straight access, the chances of removal are high

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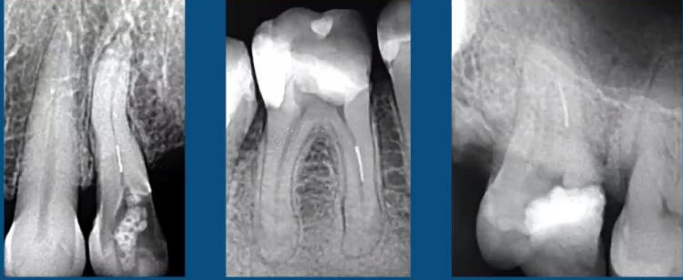
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### Location of the file




- Middle third of the root canal and before a curvature, try to remove, or option of bypassing - If the instrument is beyond a curvature, the only option is to try and bypass it.

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### Location of the file



- Apical third - Areas where removal appears to be very risky. In these areas, the instrument can be bypassed, otherwise endodontic surgery is required

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Several factors influence the possible removal of broken instruments from root canals:

3. The type of instrument.

A Sst file is generally easier to remove than a Ni-Ti file, which can be firmly inserted into the canal walls.

The length of the fractured portion should also be considered, as this may affect the method of removal.



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# Instrument Separation

Causes of Instrument Separation

Conditions for Separated Instrument Removal Attempts

**Management of Separated Instruments**

Separated Instrument Removal Technique

Prognosis



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## Managing intracanal fractured instruments:

- (1) attempting to remove the instrument nonsurgically or surgically (hemisection / root resection) - (separated instrument in apical third)
- (2) attempting to bypass the instrument, and making it part of the obturation (may lead to iatrogenic accidents such as ledge formation, perforations, and transportations, particularly in curved canals)
- (3) preparing and obturating the canal with the fractured instrument.



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## INSTRUMENT REMOVAL TECHNIQUE

1. Instrument retrieval using wire loop or tube technique
2. Bypass and braiding technique
3. Bypassing the instrument and making it part of the obturation
4. Instrument retrieval using ultrasonics or wire loop and tube technique

Most endodontists prefer ultrasonic instrumentation for the retrieval of separated instruments, as it is the most conservative of all the available methods.



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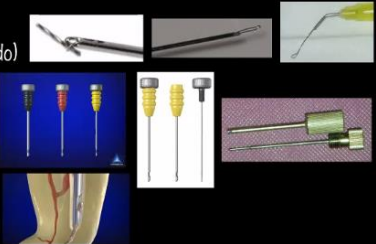
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The mechanical removal involves the use of tools dedicated to separated instrument removal such as :

Microtube Removal Methods :

1. Lasso & Anchor – The Cancellier Kit (Sybron Endo)
2. Tube & Glue
3. Tap & Thread : Post Removal System (PRS)
4. Masserann
5. Spinal Tap Needle
6. Endo Extractor/Meisinger Meitrac
7. Instrument removal system (IRS-Dentsply)

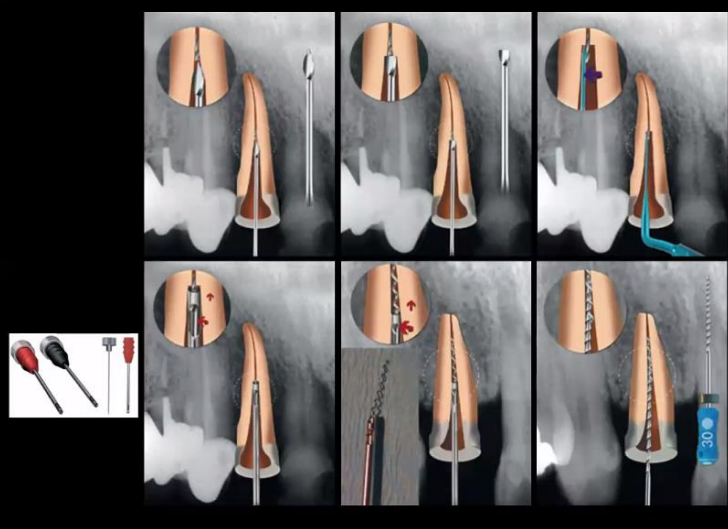



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### Microtube Removal Methods

\*) The Masserann kit (Micro-Mega, Besancon, France) - removal of separated instruments located within the straight part of the canal (at the coronal level)

\*) Required the excessive removal of dentin, weakens the root, predisposes to ledge, perforation or fracture






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The main content area displays three images related to a dental procedure. At the top left is a close-up of a metal dental instrument. Below it are two side-by-side photographs of a dental procedure in progress, showing a handpiece being used on a tooth. At the bottom center is a close-up of a different dental instrument.



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The main content area displays two dental radiographs (X-rays) of teeth. The left radiograph is labeled '92' and the right one is labeled '62'. Both images have a black arrow pointing to a specific area on the root of a tooth.



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Nonsurgical approach in of separated file :

Technique : Removal with **bypass “braiding technique”**

Location : file extends above the root canal orifice



if hand file **can bypass** the separated instrument, a **“braiding technique”** can be used (Hedstrom files) are inserted along the bypassed instrument, the files are twisted to grasp the separated instrument, and it is then extracted as one unit.



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Nonsurgical approach in of separated file :

Technique : **bypass the file**

Location of file : any location if ..... "possible"

**bypass** the separated instrument, seek for sweet zone - use small K-file inserted that spot along the separated instrument - to WL - than enlarge to certain number - follow the next step.


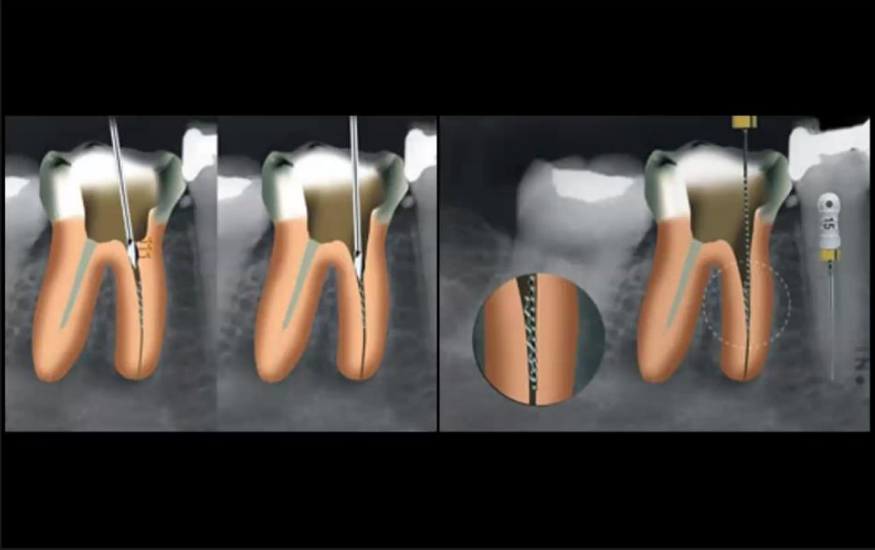


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This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side grayscale CT scan images of a human spine, showing a surgical approach. The left image shows a more anterior view, while the right image shows a slightly different angle or slice. A small video thumbnail of a man with a beard, identified as Bernard Iskandar, is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (9:48 AM), and date (8/26/2021).

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3090-36nf-bypass

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This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side grayscale CT scan images of a human spine, showing a surgical approach. The right image has the text "3090-36nf-bypass" overlaid on it. A small video thumbnail of a man with a beard, identified as Bernard Iskandar, is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (9:49 AM), and date (8/26/2021).

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3423\*\*\*(9)-17nf-bypass-Rinto




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by pass technique



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3340 (9)-15nf- bypass technique

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Nonsurgical approach in of separated file :

Technique :Removal separated instrument with Ultrasonic

Location of file : any location if ..... "possible"

- Coronal Access - Creating a Staging Platform
- Exposure of approximately 2 mm of the coronal portion of the separated file.
- Broken file removal with ultrasonic



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When a fractured instrument is below the canal orifice

**Coronal Access - Creating a Staging Platform**

- Preoperative radiograph from different angle
- Coronal access – flaring the axial wall - how big can a canal be optimally flared without creating an iatrogenic problem
- Instruments : hand K-file (small – large, coronal to obstruction)
- Modified Gates glidden drills – size 1-4 (0,50, 0,70..)

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## Creating a Staging Platform


- Use a modified GG drill – the bud of GG drill is altered by cutting perpendicular to its long axis at maximum diameter
- Use these modified GCD - carried into the preenlarged canal – directed apically until it lightly contacts the most coronal aspect of the obstruction - staging platform



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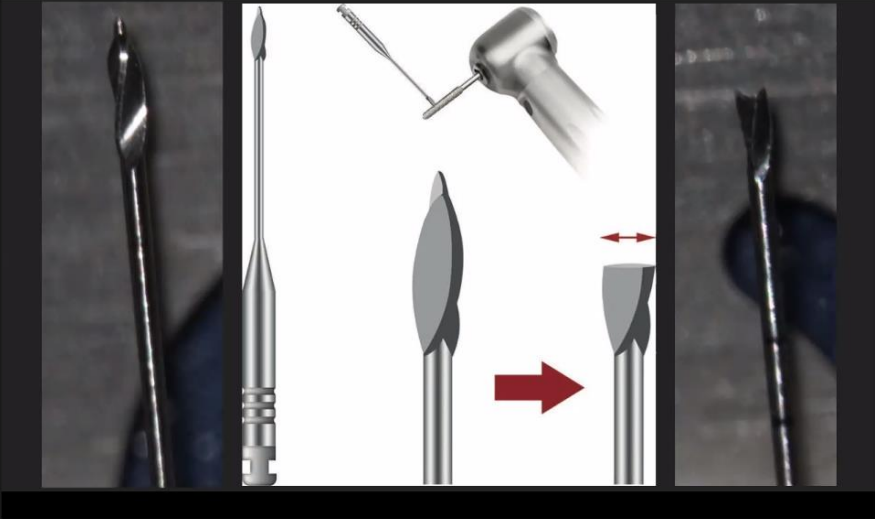


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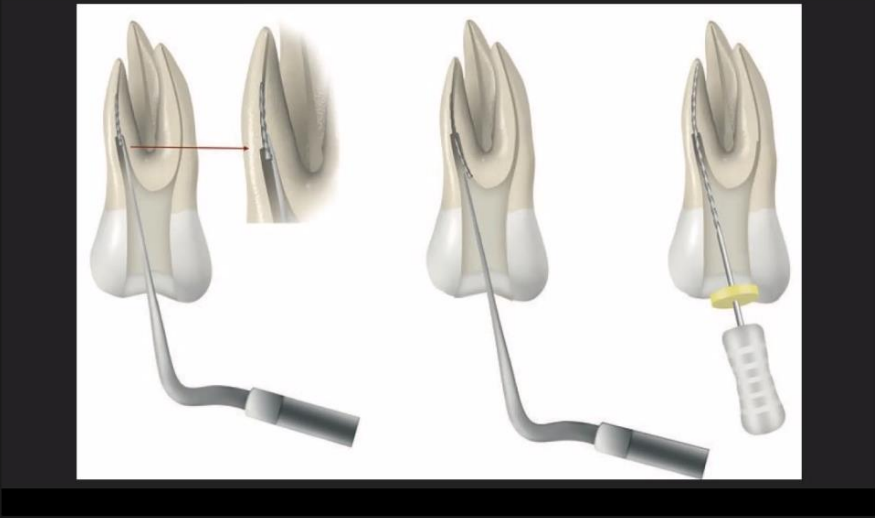
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# Creating a Staging Platform

- Use a ultrasonic tip



ET 18D

ET 19



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This screenshot shows a Zoom meeting window with a blue presentation slide. The slide title is 'Creating a Staging Platform' and it contains a bullet point: '• Use a ultrasonic tip'. Two images of ultrasonic tips are shown: one labeled 'ET 18D' and another labeled 'ET 19'. The Zoom interface includes a 'Recording...' indicator, a video thumbnail of a participant named 'Bernard Iskandar', and a Windows taskbar at the bottom with various application icons and system tray information.

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# 1#GG Creating a Staging Platform



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This screenshot shows a Zoom meeting window displaying a video. The video has a title '1#GG Creating a Staging Platform' and shows a close-up of a hand using an ultrasonic tip to work on a metal component. The Zoom interface includes a 'Recording...' indicator, a video thumbnail of a participant named 'Bernard Iskandar', and a Windows taskbar at the bottom with various application icons and system tray information.

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### Broken file removal

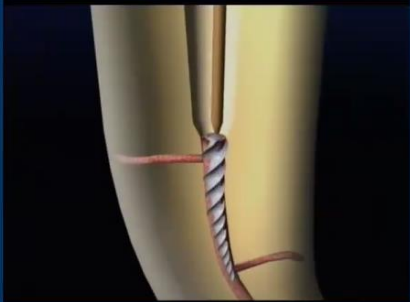
After creating a staging platform on top of the broken file

Ultrasonic tip place on staging platform

Exposure of approximately 2 mm of the coronal portion of the separated file.

Ultrasonic vibrated counter clockwise motion around file

Cover orifice of adjacent canals - prevent file jump



The diagram shows a close-up of a dental ultrasonic tip (a thin, pointed metal rod) positioned against a broken file. The tip is shown vibrating and moving in a counter-clockwise circular motion around the broken file, which is partially embedded in a root canal. The background is a dark blue gradient.

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The image shows a white plastic carrying case for a dental file retrieval kit. The case is open, revealing several blue-handled files of various sizes and shapes, along with black retrieval hooks. The case lid is printed with the text "TERAUCHI FILE RETRIEVAL KIT" and "DENTALCADRE". There are also small diagrams and labels on the lid, including "FKR-T", "FKR-1", "FKR-2", "FKR-3", and "FKR-4".

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## The success rate for removing separated files

Varies from 33% to 95%:

- the location of fractured instruments,
- the diameter of the root canal,
- the degree of canal curvature,
- the radius of curvature,
- operator experience,
- operator fatigue,
- the length of the separated instrument,
- visualization & accessibility to the separated instrument



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## The success rate for removing separated files

Accurate diagnosis and a predictable treatment plan using CBCT to prevent any procedural mishaps

High for separated files located before the canal curvature,  
Moderate for those located at the curvature,  
Low for those located beyond the curvature

Recommended time to removal should not exceed 45 to 60 minutes (the success rates may drop - because operator fatigue or overenlargement of the canal, increases the risk of perforation.

Any case where the separated instrument can be visualized under the DOM may be considered less challenging to manage.

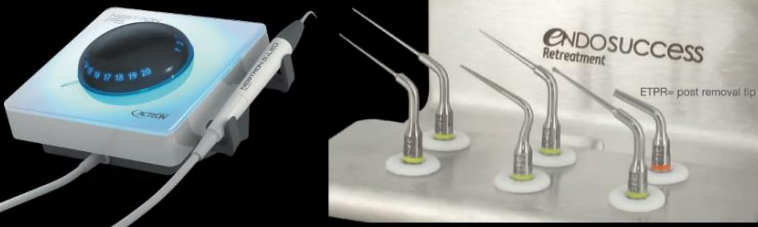


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# Ultrasonic unit and Tips



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supplied with ET18D, ET20, ET25, ET25S, ETBD and ETPR tips,

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a. Stainless steel tips, for example, ET20 tip (Acteon)  
b. Stainless steel coated with diamond tips, for example, ET 18D / 20D tip (Acteon)  
c. Titanium niobium tips, for example, ET25 tip (Acteon)

## Ultrasonics tip for instrument retrieval :



ET18D/ET20D



ET20/ET25


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*\*) Ultrasonic instruments are very effective for the removal of separated instruments.*



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This screenshot shows a Zoom meeting window with a presentation slide. The slide features two ultrasonic instruments against a dark background. The text on the slide states that ultrasonic instruments are effective for removing separated instruments. A small video feed of Bernard Iskandar is visible in the bottom right corner of the meeting window. The Windows taskbar at the bottom shows various application icons and system information.

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## Ultrasonic Technique

- Work with lower power first
- Work below the orifice is conducted DRY – vision
- Tips moved lightly in a CCW direction around the obstruction
- Heat generation by ultrasonics, temperature rise above 10°C on the external root surface can damage the periodontal tissue
- Block other canal - to prevent reentry of the fragment into another canal



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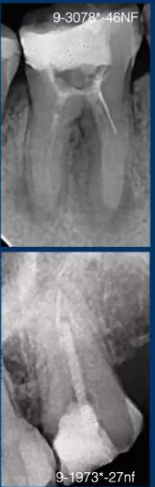

This screenshot shows a Zoom meeting window with a presentation slide titled "Ultrasonic Technique". The slide lists five key points regarding the use of ultrasonic instruments in root canal treatment. A close-up photograph of an ultrasonic instrument being used on a tooth is shown on the right side of the slide. A small video feed of Bernard Iskandar is visible in the bottom right corner of the meeting window. The Windows taskbar at the bottom shows various application icons and system information.

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The prognosis of a separated instrument inside a canal are dependent on the following:

- Location and position of the fractured instrument
- Size, type and the length of the fragment
- Degree of infection beyond the level of the separation
- Operator skill and necessary armamentarium including DOM
- Patient motivation and decision of the future course of treatment

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Recording...

## Prognosis

When an endodontic instrument separates in a canal during cleaning and shaping procedures and if it hinders adequate cleaning of the canal, then the prognosis may be affected.

Removal a separated instrument from a curved canal may cause (excessive removal of dentin structure, secondary instrument fracture, root perforation, or even root fracture). (*J Endod* 33:1070, 2007.. *J Endod* 30:177, 2004.. *J Endod* 31:450, 2005.. *J Endod* 31:845, 2005)

Spili P, Parashos P, Messer HH: The impact of instrument fracture on outcome of endodontic treatment, *J Endod* 31:845, 2005.  
 Souter NJ, Messer HH: Complications associated with fractured file removal using an ultrasonic technique, *J Endod* 31:450, 2005.  
 Saunders JL, Eleazer PD, Zhang P, Michalek S: Effect of a separated instrument on bacterial penetration of obturated root canals, *J Endod* 30:177, 2004.  
 Hashem AA: Ultrasonic vibration: temperature rise on external root surface during broken instrument removal, *J Endod* 33:1070, 2007.



ENG 10:11 AM  
INTL 8/26/2021


Zoom Meeting

Recording...

## Prognosis

The presence of a separated instrument per se in a canal or outside the root does not necessarily condemn the case to postoperative disease. Rather, it is the residual presence of any infected tissue that determines the prognosis.

The closer the root canal preparation is to the terminus at the time of instrument separation, and at later stage of canal instrumentation the better the outcome will be. (best prognosis because the canal is probably well debrided and may be relatively free from microorganisms.



ENG 10:12 AM  
INTL 8/26/2021

Windows taskbar: File Explorer, Microsoft Edge, Word, Chrome, Zoom, Play button


Zoom Meeting

Recording...

## Prognosis

If the preoperative canal is not infected, and no radicular periodontitis is associated with the root, then the presence of the separated instrument should not affect the prognosis and the separated instrument can be incorporated into root canal filling materials.

If the separated file can be removed predictably without sacrificing a significant amount of dentin, the prognosis will not be reduced. (treatment prognosis depends more on the removal of microbial infection than on instrument removal).



ENG 10:13 AM  
INTL 8/26/2021

Windows taskbar: File Explorer, Microsoft Edge, Word, Chrome, Zoom, Play button




Zoom Meeting

Recording...

### Surgical approaches should be considered in the following situations

- As a last resort if other nonsurgical approaches fail, post-treatment disease develops, and the tooth is strategically important to retain
- As a first approach when periradicular pathosis is present at the time of instrument separation, especially if the separated instrument is found in the apical third of the canal coexistent presumably with persistent extraradicular infection
- As a first approach when the radicular portion of the separated instrument is already outside the root, when an orthograde approach is unsuccessful, or when a significant amount of dentin must be sacrificed for instrument removal

Madarati AA, Hunter MJ, Dummer PMH: Management of intracanal separated instruments, *J Endod* 39:569, 2013.



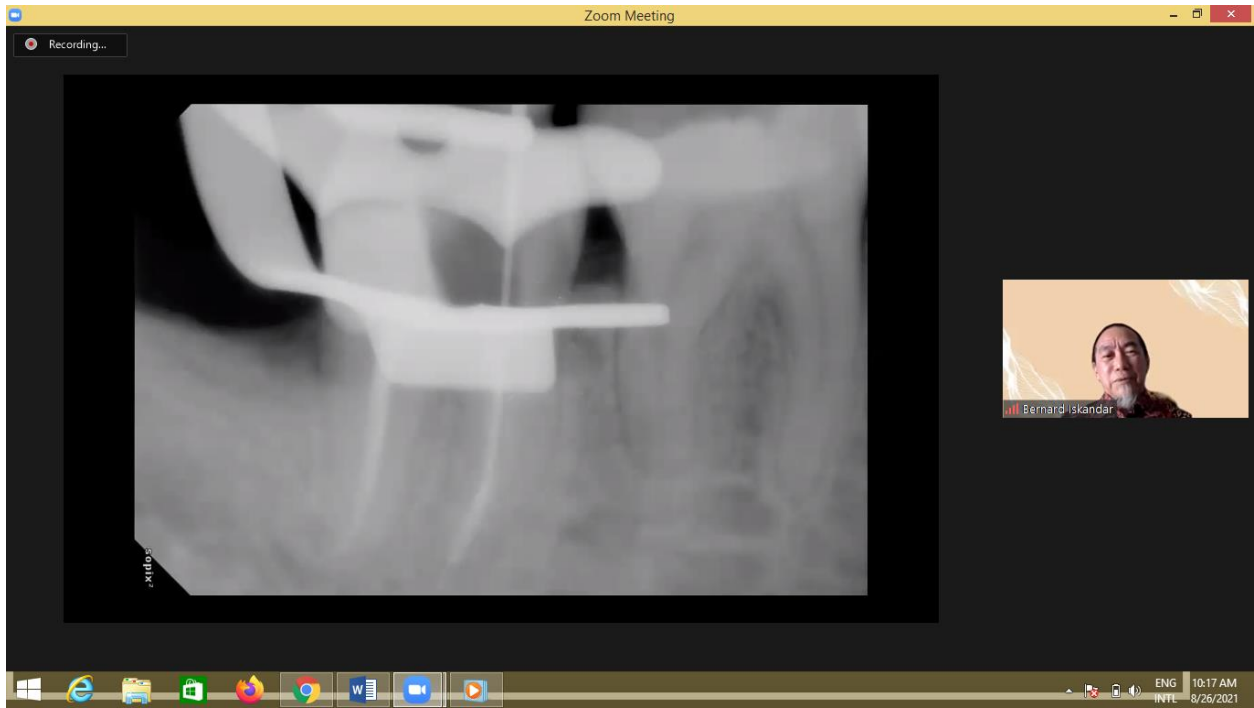
ENG 10:15 AM  
INTL 8/26/2021

Zoom Meeting

Recording...





ENG 10:16 AM  
INTL 8/26/2021



Zoom Meeting

Recording...



ENG 10:18 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a play button icon.

Zoom Meeting

Recording...



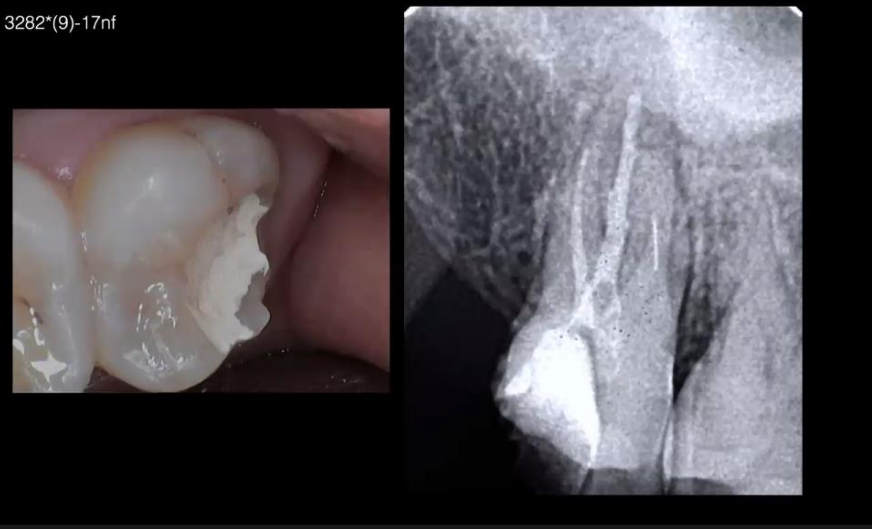
ENG 10:18 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a play button icon.

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

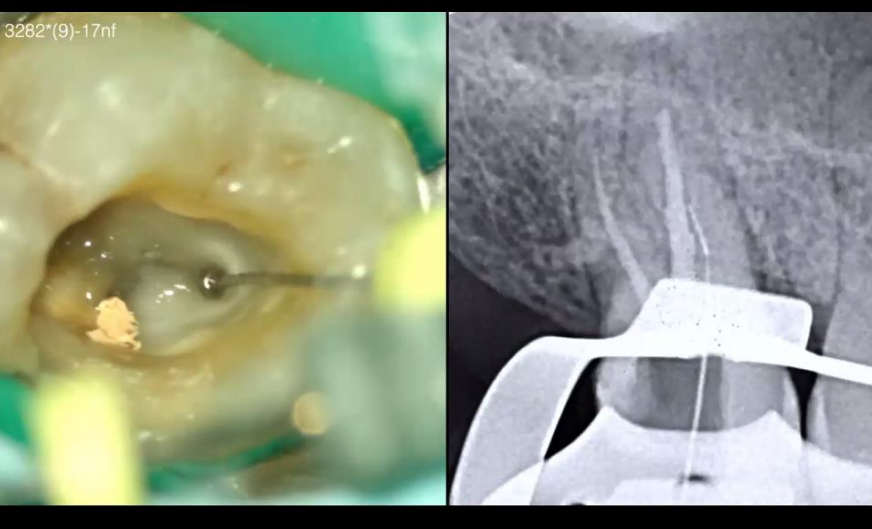
ENG 10:19 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side images of a tooth, labeled '3282\*(9)-17nf'. The left image is a clinical photograph showing a tooth with a white filling. The right image is a radiographic (X-ray) view of the same tooth, showing the internal root canal and the filling. A small video thumbnail of a man named Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time (10:19 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:19 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side images of a tooth, labeled '3282\*(9)-17nf'. The left image is a clinical photograph showing a tooth with a white filling and a yellowish substance being applied. The right image is a corresponding radiographic view of the same tooth, showing the internal root canal and the filling. A small video thumbnail of a man named Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time (10:19 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:19 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a play button icon.

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:21 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a play button icon.

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:22 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two sets of images related to a dental procedure. On the left, there are two clinical photographs of a tooth. The top photo shows a tooth with a filling, and the bottom photo shows a blue dental bur being used on the tooth. On the right, there is a radiographic (X-ray) image of the same tooth. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time (10:22 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:22 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two radiographic (X-ray) images of a tooth, showing different views of the same tooth. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time (10:22 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

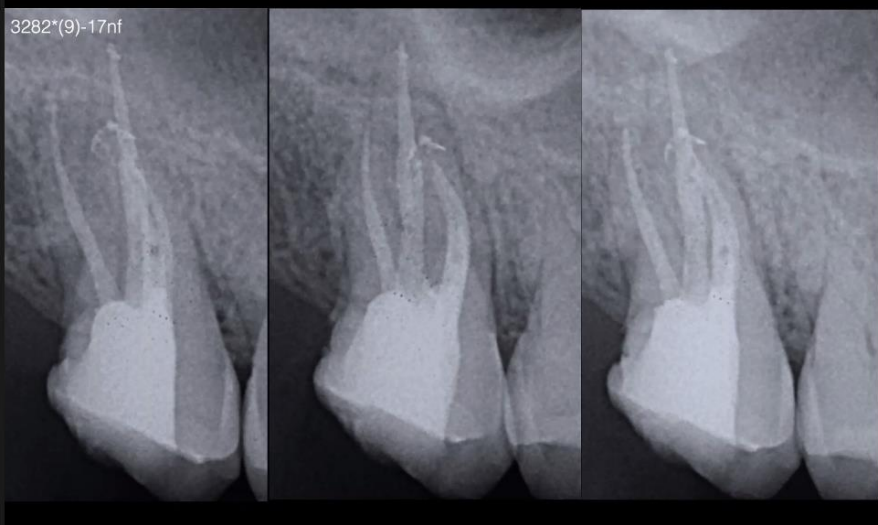
ENG 10:22 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays three side-by-side X-ray images of a vertebra, labeled '3282\*(9)-17nf'. A small video thumbnail of a participant named 'Bernard Iskandar' is visible on the right. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG/INTL), time (10:22 AM), and date (8/26/2021).

Zoom Meeting

Recording...

3282\*(9)-17nf



Bernard Iskandar

ENG 10:23 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays three side-by-side X-ray images of a vertebra, labeled '3282\*(9)-17nf'. A small video thumbnail of a participant named 'Bernard Iskandar' is visible on the right. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG/INTL), time (10:23 AM), and date (8/26/2021).

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar


ENG 10:23 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two images side-by-side: a dental radiograph on the left and a clinical photograph of a tooth on the right. The radiograph shows the root canal system, and the clinical photo shows the tooth with a filling. The meeting ID '2228-37R-NF-ML-W2' is visible in the top right corner. A small video thumbnail of the host, Bernard Iskandar, is on the right. The Windows taskbar at the bottom shows various application icons and system tray information including the time '10:23 AM' and date '8/26/2021'.

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

ENG 10:26 AM  
INTL 8/26/2021

This screenshot shows the same Zoom meeting window, but the main content area now displays only the dental radiograph. Three black arrows are overlaid on the radiograph, pointing to specific areas of interest within the root canal system. The meeting ID '2228-37R-NF-ML-W2' remains in the top right corner. The video thumbnail of Bernard Iskandar is still present on the right. The Windows taskbar at the bottom shows the time updated to '10:26 AM' and the date '8/26/2021'.



Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

ENG 10:27 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content is a close-up photograph of a dental procedure on a tooth. An inset image in the upper right of the main photo shows a different view of the same tooth. The Zoom interface includes a video thumbnail for 'Bernard Iskandar' on the right and a Windows taskbar at the bottom with various application icons and system tray information.

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

ENG 10:28 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content consists of two side-by-side radiographic images of teeth, likely periapical views, showing the root canal system and surrounding bone structure. The Zoom interface includes a video thumbnail for 'Bernard Iskandar' on the right and a Windows taskbar at the bottom with various application icons and system tray information.

Zoom Meeting window showing a dental radiograph. The radiograph displays a tooth with a root canal. An arrow points to the root canal, labeled "Mesio Lingual". The meeting ID is 2228-37R-NF-ML-W2. The interface includes a recording indicator, a toolbar with options like Unmute, Start Video, Security, Participants (59), Polls, Chat, Share Screen, Pause/Stop Recording, Breakout Rooms, Reactions, and More, and a video thumbnail of Bernard Iskandar. The system tray shows the time as 10:29 AM on 8/26/2021.

Zoom Meeting window showing two side-by-side clinical photographs of a tooth preparation. Both images show a root canal with a white arrow pointing to the canal. The meeting ID is 2228-37R-NF-ML-W2. The interface includes a recording indicator, a toolbar with options like Unmute, Start Video, Security, Participants (59), Polls, Chat, Share Screen, Pause/Stop Recording, Breakout Rooms, Reactions, and More, and a video thumbnail of Bernard Iskandar. The system tray shows the time as 10:29 AM on 8/26/2021.

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

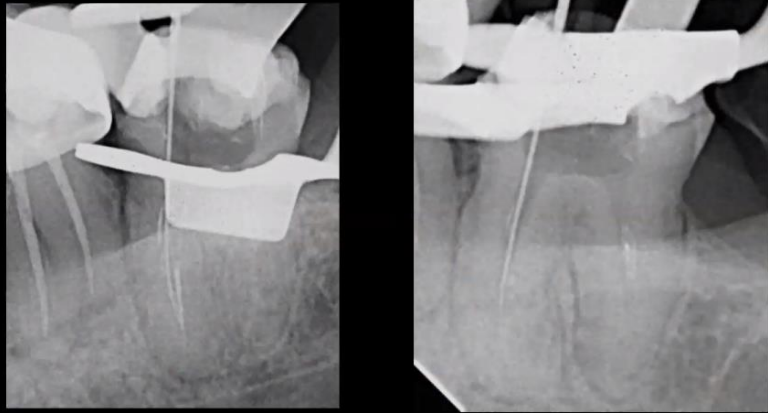
ENG 10:31 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two clinical photographs of a tooth. The left image shows a close-up of the tooth with a white arrow pointing to a dark spot on the root. The right image shows the same tooth with a metal instrument, possibly a file, inserted into the root canal. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:31 AM) and date (8/26/2021).

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

ENG 10:31 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two periapical radiographs (X-rays) of a tooth. The left image shows a standard periapical view. The right image shows the same tooth with a thin, dark line representing a file or instrument inserted into the root canal. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:31 AM) and date (8/26/2021).

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Remove Spotlight

Bernard Iskandar


ENG 10:31 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side close-up photographs of a dental procedure. The left image shows a dental preparation with a dark, circular opening. The right image shows a similar view from a slightly different angle. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (10:31 AM), and date (8/26/2021).

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



Bernard Iskandar

ENG 10:32 AM  
INTL 8/26/2021


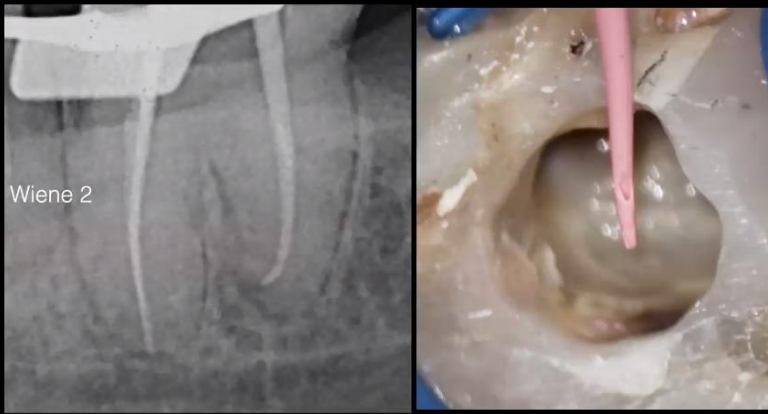
This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side photographs of a dental procedure. The left image shows a dental preparation with a blue bur being used on a tooth. The right image shows a close-up of a dental preparation with a white strip. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (10:32 AM), and date (8/26/2021).

Zoom Meeting

Recording...

2228-37R-NF-ML-W2

Wiene 2



ENG 10:33 AM  
INTL 8/26/2021

Windows taskbar icons: Edge, File Explorer, Teams, Firefox, Chrome, Word, Zoom, Play.

Zoom Meeting

Recording...

2228-37R-NF-ML-W2



ENG 10:33 AM  
INTL 8/26/2021

Windows taskbar icons: Edge, File Explorer, Teams, Firefox, Chrome, Word, Zoom, Play.

Zoom Meeting

Recording...

2228-37B-NF-ML-W2



Bernard Iskandar

ENG 10:34 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two dental radiographs of a tooth. The right-hand radiograph is labeled with the alphanumeric string '2228-37B-NF-ML-W2'. A small video thumbnail of a participant named 'Bernard Iskandar' is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time and date.

Zoom Meeting

Recording...

3461\*\*\* (9)-46nf3



Bernard Iskandar

ENG 10:34 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays a composite image. On the left is a dental radiograph of a tooth. On the right are three clinical photographs of the same tooth, showing the crown and root area from different perspectives. A small video thumbnail of a participant named 'Bernard Iskandar' is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including the time and date.

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



ENG 10:36 AM  
INTL 8/26/2021

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



ENG 10:37 AM  
INTL 8/26/2021

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3




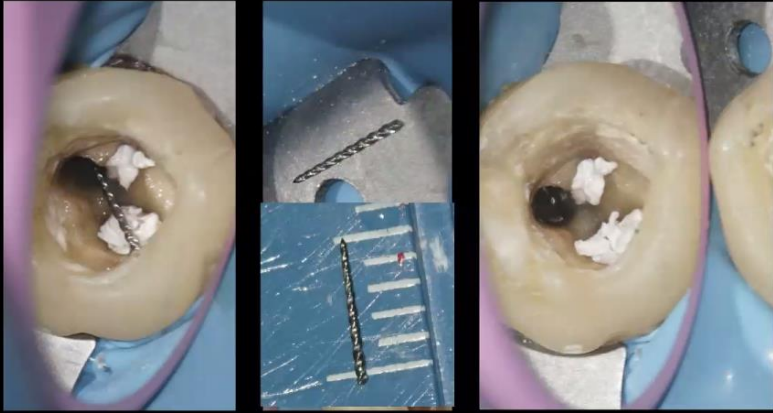
ENG 10:37 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a media player.

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



ENG 10:38 AM  
INTL 8/26/2021

Windows taskbar icons: File Explorer, Microsoft Edge, Google Chrome, Word, Zoom, and a media player.



Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



Perforation



ENG 10:39 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window. The main content area displays three images related to a dental procedure. On the left is a radiograph (X-ray) of a tooth, with a white arrow pointing to a dark spot labeled 'Perforation'. To the right are two clinical photographs of the tooth, showing a large filling. A small video feed of a man with a beard, identified as 'Bernard Iskandar', is visible on the right side of the screen. The Windows taskbar at the bottom shows various application icons and the system clock indicating 10:39 AM on 8/26/2021.

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



Perforation



ENG 10:40 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window, similar to the one above. The main content area displays three images. On the left is a clinical photograph of a tooth with a filling. In the middle is another clinical photograph showing a red rubber dam being used on the tooth. On the right is a radiograph of the tooth, with a white arrow pointing to a dark spot labeled 'Perforation'. The video feed of 'Bernard Iskandar' is visible on the right. The Windows taskbar at the bottom shows the system clock indicating 10:40 AM on 8/26/2021.

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



ENG 10:40 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two grayscale CT scan images of a maxillary molar tooth, showing the root and crown structure. A small video thumbnail of Bernard Iskandar is visible on the right side. The Windows taskbar at the bottom shows various application icons and system information including language (ENG), time (10:40 AM), and date (8/26/2021).

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



ENG 10:41 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side images: on the left, a grayscale CT scan of a maxillary molar; on the right, a clinical photograph of a maxillary molar with two orange-colored restorations. A small video thumbnail of Bernard Iskandar is visible on the right side. The Windows taskbar at the bottom shows various application icons and system information including language (ENG), time (10:41 AM), and date (8/26/2021).

Zoom Meeting

Recording...

3461\*\*\*(9)-46nf3



Bernard Iskandar

ENG 10:41 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two dental radiographs. The left image is a periapical view of a tooth with a root canal filling. The right image is a panoramic view of the same tooth, with a white arrow pointing to the root canal filling. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (10:41 AM), and date (8/26/2021).

Zoom Meeting

Recording...

3491(9)-47-nf



Bernard Iskandar

ENG 10:42 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays a clinical photograph of a tooth with a root canal filling on the left and a corresponding periapical radiograph on the right. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system tray information including language (ENG), time (10:42 AM), and date (8/26/2021).

Zoom Meeting

Recording...

3491(9)-47-nf


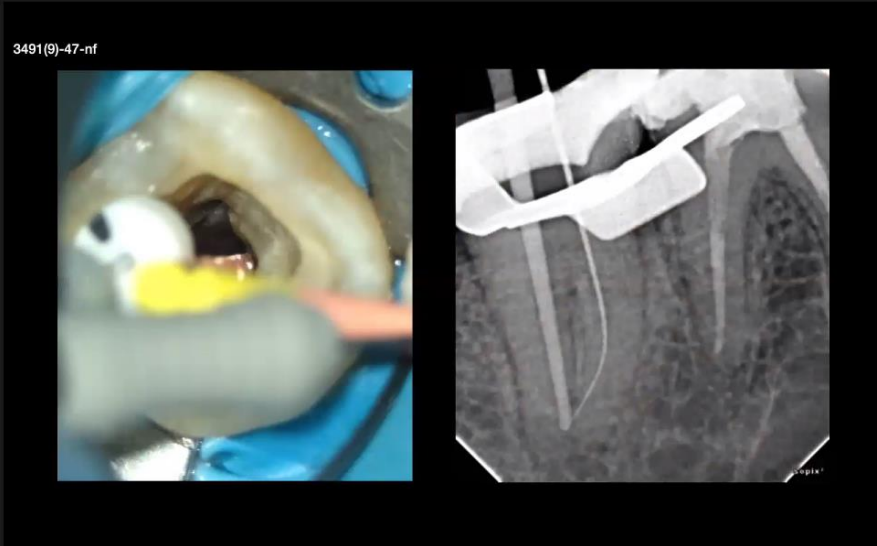


ENG 10:43 AM  
INTL 8/26/2021

Zoom Meeting

Recording...

3491(9)-47-nf

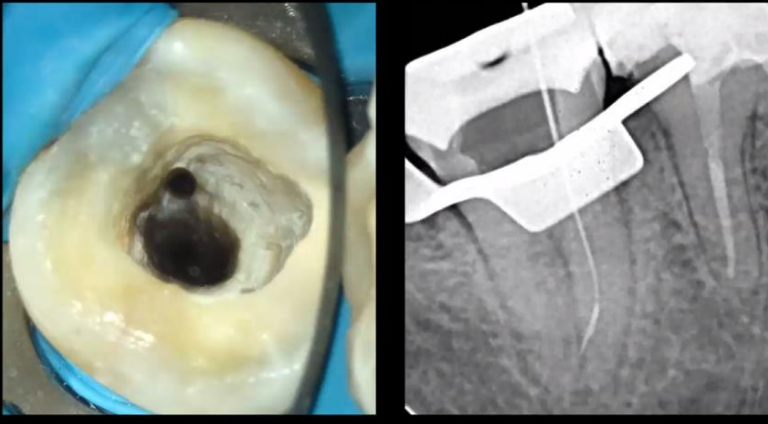


ENG 10:43 AM  
INTL 8/26/2021

Zoom Meeting

Recording...

3491(9)-47-nf



Bernard Iskandar


ENG 10:44 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side images of a dental crown. The left image shows the crown with a dark, circular opening in the center. The right image shows a close-up of the crown's surface with a white, rectangular object (possibly a wax or a piece of paper) placed over it. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:44 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3491(9)-47-nf



Bernard Iskandar


ENG 10:44 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side close-up images of a dental crown. The left image shows a dark, circular opening in the center of the crown. The right image shows a close-up of the crown's surface with a white, rectangular object (possibly a wax or a piece of paper) placed over it. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:44 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3491(9)-47-nf



Bernard Iskandar

ENG 10:45 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side photographs of a dental preparation. The left image shows a white paper strip on a grey surface, possibly a dental tray. The right image is a close-up of a tooth with a dark, circular preparation. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:45 AM) and date (8/26/2021).

Zoom Meeting

Recording...

3491(9)-47-nf



Bernard Iskandar

ENG 10:45 AM  
INTL 8/26/2021

This screenshot shows a Zoom meeting window with a recording indicator. The main content area displays two side-by-side photographs of a dental preparation. The left image shows a tooth with a dark preparation and a white filling material being applied. The right image shows the same tooth with the white filling material fully in place. A small video thumbnail of Bernard Iskandar is visible on the right side of the meeting window. The Windows taskbar at the bottom shows various application icons and system information including the time (10:45 AM) and date (8/26/2021).

Zoom Meeting window showing a dental procedure. The main content area displays two side-by-side images of a tooth preparation. The left image shows a tooth with a root canal and a blue bur being used on the crown. The right image shows the same tooth with a red bur being used on the crown. The meeting title is "3491(9)-47-nf". The Zoom control bar at the bottom includes options for Unmute, Start Video, Security, Participants (59), Polls, Chat, Share Screen, Pause/Stop Recording, Breakout Rooms, Reactions, and More. The system tray shows the time as 10:45 AM on 8/26/2021.

Zoom Meeting window showing dental radiographs. The main content area displays three images: a clinical photograph of a tooth preparation on the left, and two radiographic images on the right. The radiographs show the root canal and the placement of a material. A blue arrow points to a label "MTA" in the bottom-left radiograph. The meeting title is "3491(9)-47-nf". The Zoom control bar at the bottom includes options for Unmute, Start Video, Security, Participants (59), Polls, Chat, Share Screen, Pause/Stop Recording, Breakout Rooms, Reactions, and More. The system tray shows the time as 10:46 AM on 8/26/2021.

Zoom Meeting

Recording...

## Take home message


Curved canals are a higher risk for instrument fracture than straight canals.

In curved canals rotary instruments (including lentulo spirals) fractured more often than other instruments.

The use of an operating microscope and Ultrasonic device was a prerequisite for the techniques used

Referral might be in the patient's best interest



The presence of clinical symptoms and or radiographic pathology — surgery or extraction may be the best treatment option




ENG 10:46 AM  
INTL 8/26/2021

Zoom Meeting

Recording...



# Thank You



ENG 10:47 AM  
INTL 8/26/2021