

# Endodontic Failures

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Millions of Endodontic procedures are carried out worldwide today by Endodontists as well as general clinicians with different levels of practicing skills. The success rate of these procedures varies due to many reasons. The aim of this article is to review the various possible causes of "endodontic failures" and how these can be possibly avoided or reduced.

Before we set out to announce a procedure as an "endodontic failure", it is important to know what is the criteria to adjudicate a procedure as "success".

A successful procedure is defined as a procedure with "a complete absence of clinical signs and symptoms" because the criteria of radiographic evaluation is not reliable. The radiographic evaluation of an "endodontic failure" or "nonhealing" holds ground only if there is no complete histological healing or in other words the radiolucency is either "unchanged" or "has increased in size".

The most common causes of an endodontic failure could be any of the following:

1. Incorrect access preparation
2. Root canal system not completely cleaned and shaped.
3. Instrument separation
4. Perforations
5. Root canal System not obturated completely
6. Faulty restorations

## 1. Incorrect Access Preparation :

Access preparation is the first step towards achieving a successful endodontic procedure. One should keep the anatomy and morphology of the tooth in mind before attempting the access preparation. The anatomy and morphology varies between different groups of teeth and the design of the access preparation is dictated accordingly. It is also important to see the long axis of the tooth in the jaw and the relationship of the particular tooth to its adjacent teeth. The purpose of the access

preparation is (a) to locate all the canals (b) to remove the roof of the pulp chamber to ensure the complete removal of all the pulpal tissue from the chamber (c) to have a preparation which provides a straight line access of the instrument from cavity preparation to the apical third of each canal and of course (d) conserve the tooth structure as much as possible for the future restorations.

The general principles of access preparation which the clinicians need to keep in mind are that it helps you reach the diagnosis/ the possible cause leading to the endodontic procedure. Firstly all the caries should be removed to ensure good visibility to locate any cracks/ fractures as the possible cause, have an aseptic environment and plan the post endodontic restoration and its long term prognosis. It is the time to take the call if the tooth is worth preserving and if any periodontal treatment might be required to restore it. Remember an old saying "Always start with the end in the mind". All restorations causing obstruction to achieve straight line access should be removed, it also prevents the debris to accumulate in the canals. The outline form of the access preparation is governed by the radiographic assessment of the pulp chamber and the location of the root canal space. There might be a need to take more than one radiographic quite often to ascertain the number of roots and their anatomy. The preparation is modified to include all orifices, so that they all can be seen in the mirror without moving it. In the present day endodontics it is difficult to imagine an endodontic procedure without some kind of magnification preferably a microscope. The present day endodontic procedures with nickel titanium instruments has made it mandatory to have a straight line access till the apex of the canal system. The preparation should be able to make a room for it.

The ultimate aim of any endodontic procedure is to achieve a three dimensional

obturation. All the debris has to be removed to facilitate a good obturation. It is a well accepted fact that the instruments shape the canals and irrigants clean it. To ensure a good amount of irrigant in the root canal system the access opening plays an important role. The preparation should be able to hold a good amount of irrigant and also allow the irrigant to reach the apical area of the root canal (after the removal of carious dentin a temporary restoration might be required to do so).

## 2. Root Canal System Not Completely Cleaned & Shaped:

The aim of cleaning in the course of root canal therapy is to ensure the elimination of all the inflamed or necrotic pulp tissue and the microorganisms associated with it. It is a well established fact that the microorganisms within the root canal space travel into the dentinal tubules. The cleaning of the root canal space should ensure that they are either removed totally or reduced to a number to make them ineffective or entomb them to prevent any reinfection. It is important to remember the tooth morphology which can include the lateral canals, accessory canals, canal wall irregularities, isthmuses etc. while cleaning the canals.

Cleaning and shaping are the two major goals of canal preparation which though different are achieved by similar means. Ideally the instrument needs to touch all the walls of the canal to debride and shape it while the chemical actions of irrigants further dissolves the organic remanants, destroys the bacteria and flushes the debris out of the canal leaving it clean. But in reality with the present means and techniques we manage to achieve a "significant reduction" in the bacterial count and not complete debridement.

The remaining debris may get sequestered during obturation but this will not last indefinitely. with time the sealer may be washed out or communications develop thus leading to "short term treatment success but long term treatment

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failure". Thus it is of the utmost importance to maximise the canal debridement during the cleaning and shaping of the canals.

**3. Instrument Separation :** Of all the complications occurring during the procedure the worst is instrument breakage or file separation in the canal because of its consequences. When a small number file is broken in the canal it effectively blocks the canal thus rendering us unable to remove the dead or necrotic pulp tissue which further leads to infection or chronic inflammation and thus to endodontic failure.

If a large number file is broken then it may be by passed but sealing the canal may pose a problem and eventually will be a cause for failure. Hence for the success of the procedure it is extremely essential to remove the instrument.

The knotting up or unravelling of the flutes lead to breakage which can be easily avoided by ensuring that no more than 1-3mm of the tip binds with the apical end while working. Cutting in a wet canal also reduces chances of breakage, as does examination of instrument after usage for a shiny spot or knot.

The recently introduced Ni-Ti files are more prone to breakage as they begin to microfracture as soon as used. In the rotary handpiece, the combination of compressive and tensile stress causes the file to break even sooner. The faster you rotate the file and the more you bend the rotary instrument, the quicker it fractures. Unfortunately, NiTi instruments tend to fracture with no visible warning. The instrument may look perfectly normal, yet fracture in the tooth.

If you are diligent and examine every file before use, don't overuse them, and don't overstress them, then you will keep your breakage to a minimum.

**4. Perforations :** Close attention must be paid to the anatomic variations in the configuration of various teeth, their inclination to the adjacent teeth and alveolar bone and their root morphology else there are increased chances of gouging or perforation of the crown or root at various levels.

Along with this radiographs with a varying horizontal angle are also helpful in supplying additional information about the size, shape and internal changes in the pulp chamber.

When a perforation occurs or is strongly suspected, the patient should be considered for referral to an endodontist. Also, after long-term evaluation, other procedures such as surgery may be necessary.

Early signs of perforation may include one or more of the following:

- (1) Sudden pain during the working length determination when local anesthesia was adequate during access preparation;
- (2) Sudden appearance of hemorrhage;
- (3) Burning pain or a bad taste during irrigation with sodium hypochlorite;
- (4) Other signs, including a radiographically malpositioned file or a periodontal ligament reading from an apex locator that is far short of the working length on an initial file entry.

The location and size of a lateral perforation are important in predicting its outcome. If the defect is located at or above the height of crestal bone, the prognosis for perforation repair is favorable. These defects can be easily "exteriorized" and repaired with standard restorative materials

Teeth with perforations below the crestal bone in the coronal third of the root generally have the poorest prognosis. Attachment often recedes and a periodontal pocket forms, with attachment loss extending apically to at least the depth of the defect.

Perforation in the furcation area can be either direct or strip type. The direct type is seen as a punched out defect due to the bur where as the stripping defect results from excessive flaring with files or drills. Long-term failure results from leakage of the repair material, which produces periodontal breakdown with attachment loss. Skillful use of MTA offers the best result for perforation repair.

**5. Root Canal System Not Obturated Completely :** The purpose of obturation is to seal already cleaned and shaped root canal. It also aims to entomb remaining bacteria in root dentine. one of the common

reasons for treatment failure is inadequate obturation of root canal system. A good cleaning and shaping protocol facilitates optimum obturation. The evidence suggests that root fillings extending to within 2 mm of radiographic apex offers most favourable outcome. The use of electronic apex locators can help in achieving correct working length for the endodontic cases which is integral to shaping and obturating procedures. The long root fillings can at times sustain periapical inflammation and therefore either hinder or delay healing. The short root fillings are also associated with un-favourable outcome as the microorganisms in apical section of unfilled canal can sustain the periapical lesion. The importance of apical seal therefore cannot be overemphasised.

The newer techniques for obturating the canals like continuous wave obturation, warm vertical condensation aims at removing the limitations of older techniques like cold lateral condensation. They offer better sealing of root canal system in three dimension.

**6. Faulty Restorations :** The coronal restoration of the root treated tooth is the integral part of the obturation as the restoration prevents coronal leakage. The coronal seal is supposed to be more important as gutta percha does not provide hermetic seal within the canals. The microorganisms can reach from coronal aspect of canal to apical section in few days in a tooth where root filling is exposed to oral cavity.

The best way to ensure good coronal restoration is to make sure that all cavity margins are supragingival before restoring a tooth. An extracoronary restoration is essential in providing the coronal seal as well as preventing fracture of tooth. This can be either achieved with a crown or an onlay. If the root filled tooth needs to be monitored over a period of time, then a orthodontic band or an amalgam onlay can be given to prevent any fracture.

To conclude, most of the endodontic failures are avoidable if the clinicians follow the recommended protocol, use the instruments judiciously and patiently.

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