Restoration of vital teeth with significant crown destruction

Basic steps

- Initial removal of caries-altered enamel and dentin.
- Removal of parts of present obturations.
- Preparations of the clinical crown parts, which are directly exposed to direct masticatory load and would not withstand during functioning.
- Analysis of the remaining dental structures.

- Analysis of preserved tooth structures
- redistribution of force stress in the range of the clinical crown
- different features in the masticatory pressure of the teeth in both jaws and different functional groups


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- Risk assessment of developing caries of the rest dental structures. At risk - change the treatment plan from conservative to prosthetic.
- Assessment of the periodontal status – observe the furcation in multi-root teeth.
- Assessment of the ratio “clinical root - clinical crown” – if unfavorable before the restoration, it can be more unfavorable after.
- Enhanced mobility can also be transformed into pathological mobility.

- Assessing the endodontic state (EPT, X-ray)
- Severely destroyed teeth are not appropriate for biological treatment.
- At risk of complications - it is needed to explain to the patient and make a decision for the treatment plan.

DESTRUCTION SIZE AND DIRECTION

- Mesio-distal, bucco-lingual destruction.
- Occlusal-apical (axial) destruction.

  The larger the destruction is the harder is to provide the resistance and retention of the restoration.

Mesio-distal or bucco-lingual destruction

- With preserved axial crown edges - easier to achieve better resistance.
- The main problem is the retention and blocking of over-lapping horizontal forces.
- In case of destroyed axial edges – danger of crown fracture.
- In case of destruction of the occlusal marginal ridges – risk of splitting tooth fracture.

Thinning of the marginal occlusal ridges – risk of splitting tooth fracture; partial or complete destruction of the tooth cusp

MOD cavity – reduces the volume of hard dental tissue, presenting a problem for both resistance and retention; risk of splitting tooth.

Occluso-apical (axial) destruction

- Partial or complete cusp destruction of BLS (bucco-lingual size) >2/3 of ICD (inter-cuspal distance) and depth of 2-2,5 mm and more
- Axial reduction is not a resistance problem but a retention one.

Preparation of vital teeth with significant destruction of the clinical crown

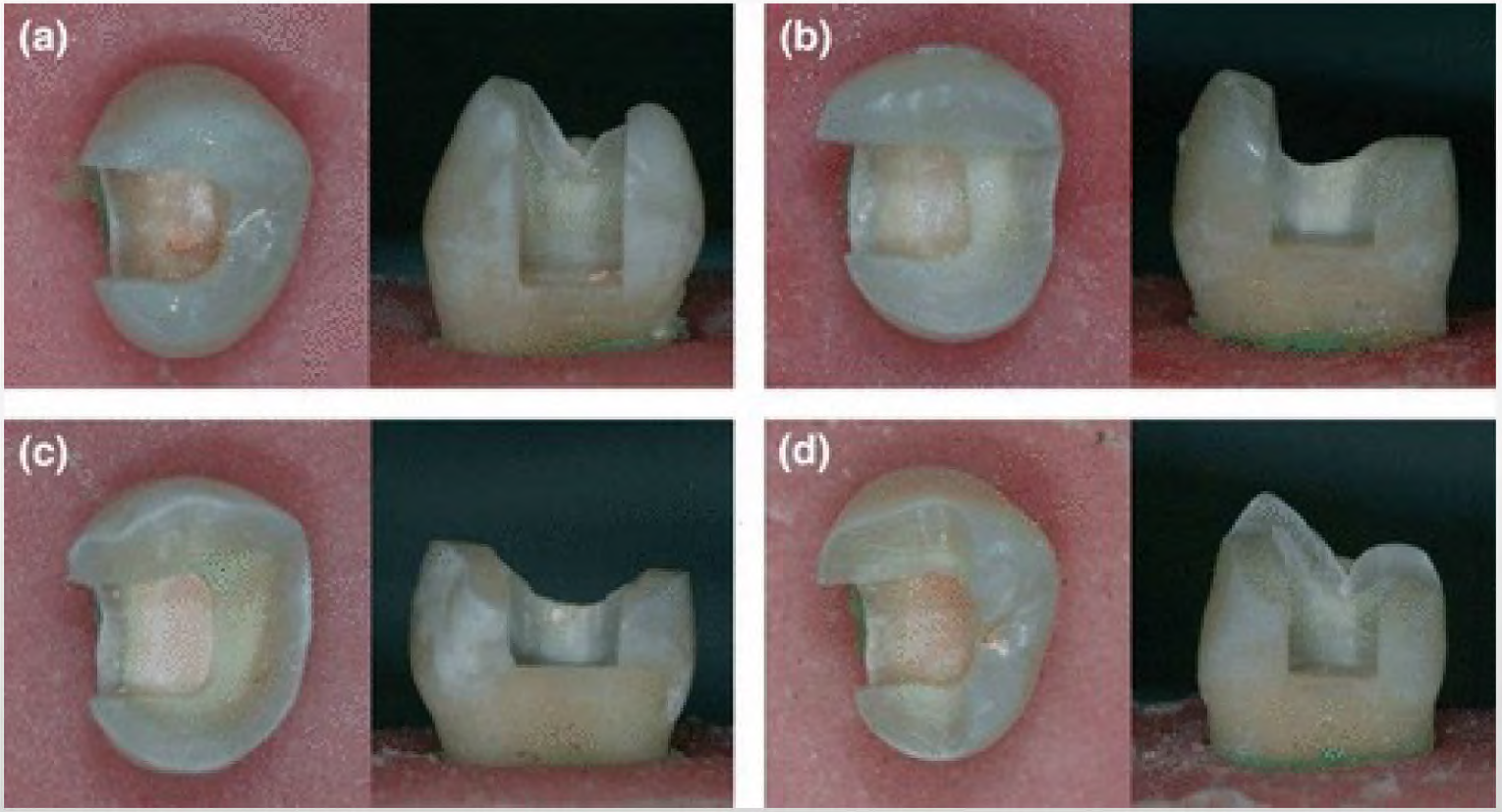
- Horizontal cuts:
  - Pulp floor – should be horizontal or around the periphery of the carious defect (the base equalizes the pulp floor but does not redistribute masticatory load).
  - Gingival floor – 1/3-1/2 should be made horizontal,
    - Transition parts (horizontal) when preparing the bevel and counter-bevel.
    - Ledges - when preparing overlay and slot retention.

- Requirements for horizontal ledges - perpendicular to the axial forces;
- smooth transitions to the remaining cavity parts;
- sufficient thickness of the restorative material to the antagonists.
- Marginally, the ledges are to be perpendicular to the enamel surface or bevel-prepared according to the type of material.

Retentions

- Every cavity part should be with its own retentions.
- When observing mesio-distal and bucco-lingual destruction:
  - Solution:
    - In case of severely damaged walls – buccal or lingual – wall reduction, para-pulpal pin in the area of missing wall or usage of adhesive technique.

- In case oflarge destruction of the occlusal marginal ridge and weakening of the buccal and lingual walls and depth of over 2,5 mm (MO,DO,MOD) – axial reduction of the walls.
- MOD cavity with weakened buccal and lingual walls – axial reduction of the walls and covering them with the restoration material, the restoration should “line” the other walls.
- Indirect or direct resin composite restoration.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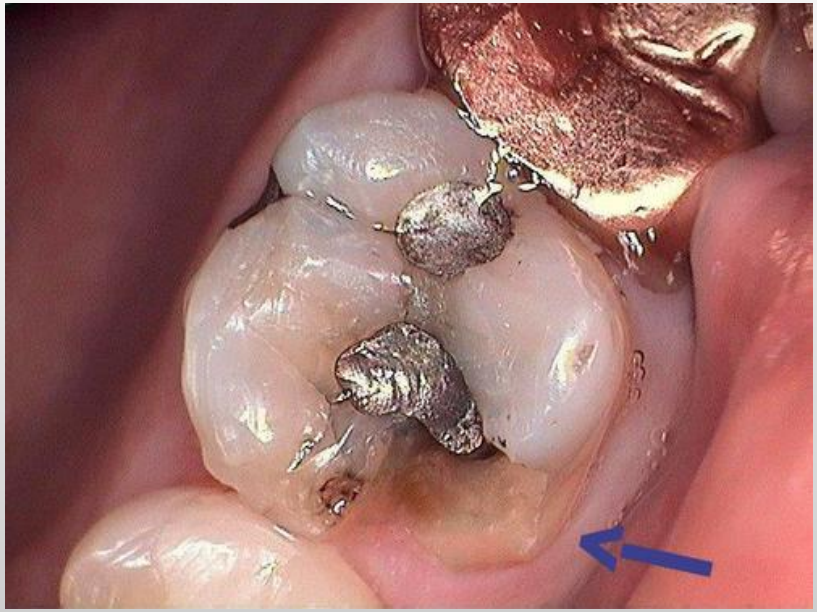
Destruction of the axial edge

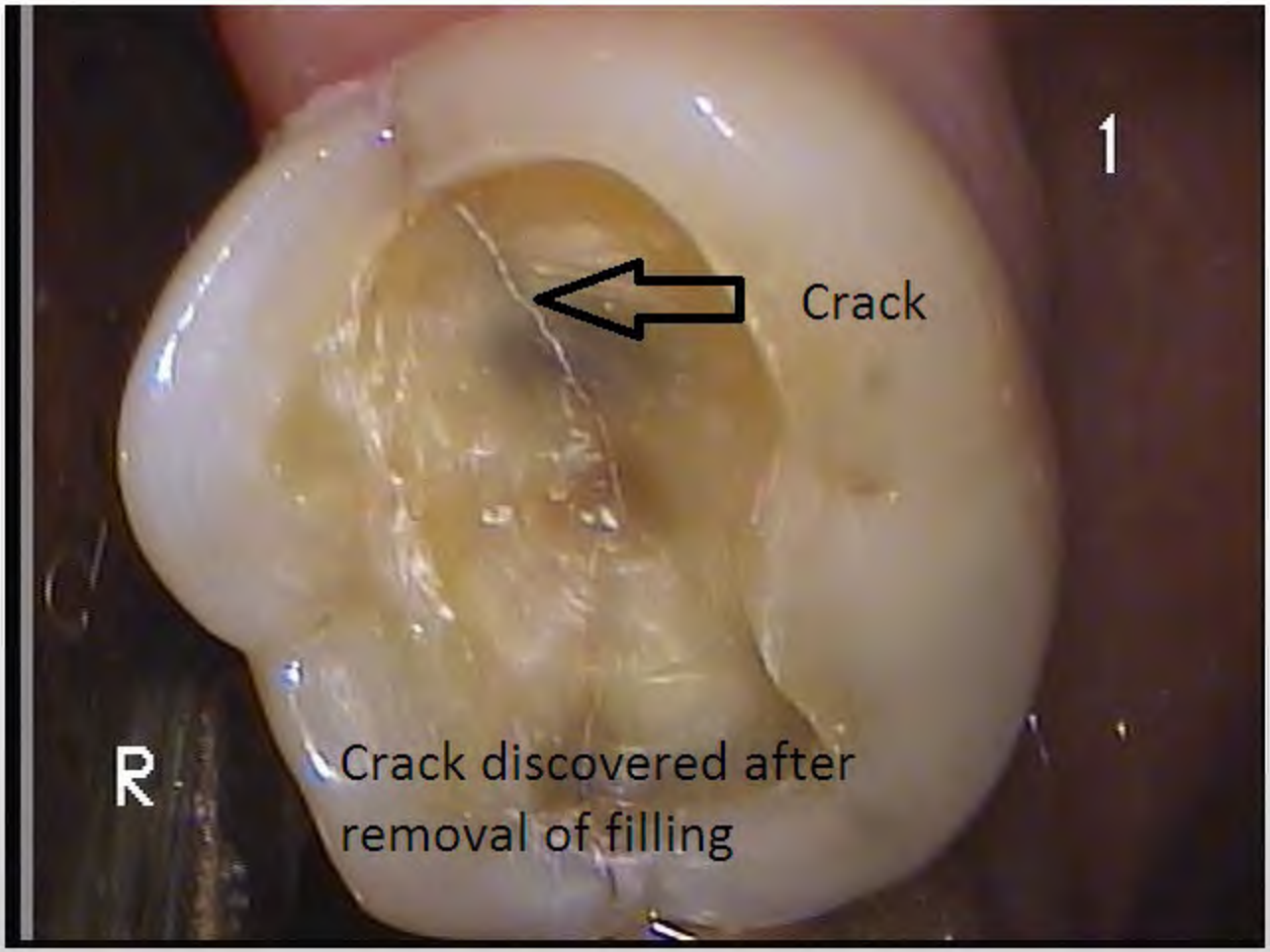
- Complete cavity preparation includes:
  - Rounded axio-pulpal edge.
  - Creation of horizontal (in the gingival floor, pulp floor, vestibular and lingual) and vertical cuts.
  - Sufficient space and volume for the restoration material in the area of the destroyed axial edge.
  - Preparation of additional retentions for the axial edge restorations – dentinal groove retentions (axial, gingival), parapulpal pins, adhesive systems.

- Second chamber retention in the opposite cavity part.
- Slot retention with enough hard dental tissue (molars and premolars).
- Parapulpal pin.
- The vitality of the tooth is at risk.



Cracks in hard dental tissues

- Affect the enamel or both enamel and dentin.
- Can lead to increased sensitivity.
- Can be interpreted as a condition of occurrence or consequence of secondary caries.
- The presence of a crack can lead to fracture following restoration with time.
- In case of incomplete fracture -”cracked tooth syndrome” can be observed.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Crack
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Crack discovered after
removal of filling



Cracked tooth syndrome

- Can be observed in both intact teeth and teeth with restorations.
- Mostly affects premolars and molars in the maxilla (upper jaw) and molars in the mandibula (lower jaw).
- Can be observed in patients with para-functional or impaired occluso-articulation ratios.

Cracked tooth syndrome

- Clinical observations – primarily cracks affecting dentin
- Patients complain of increased sensitivity regarding thermal and chemical irritants - acute but short-lasting pain during chewing
- Pathological processes in the dental pulp may occur

Cracked tooth syndrome

- Difficult to establish accurate diagnosis.
- Patients are rarely able to point out the affected tooth.
- Most applicable are color tests usin dyes, transillumination, fluorescence and “stick bite test”.

"STICK BITE TEST"

- The patient bites down on a stick made out of wood, a rubber piece or a special device, used to recreate the pain sensation. This facilitates the clinician to detect the fractured tooth.
- After the removal of restoration - the crack is visualized .
- Diagnostics is considered successful, if all patient complaints disappear after treatment.

Preparation of cracked teeth

- The whole crack is removed during the cavity preparation.
- Areas, susceptible to fractures, are removed (cusps, walls).
- Dental amalgam is not an appropriate material due to the necessity of extension in the cavity form, micro-retentions in the reduced volume of dentin and enamel and its poor mechanical durability.

Preparation of cracked teeth

- Appropriate restorations – indirect cast restorations (inlay, onlay and overlay), esthetic materials (direct and indirect).
- The esthetic adhesive materials allow for a sparing mechanical treatment.

- On frontal teeth, using a round burr, a cut is made along the crack with or without additional extension at its end.
- Ledge/step at the base of the crack with enough hard dental tissue apically underneath it.
- The retentions necessitate location in areas with most preserved hard dental tissue and should not be a source of pressure. Multilateral stabilization needs to be created.

When restoring teeth with large hard dental tissue (HDT) destruction we should consider:

- The type of teeth for restoration – the lower teeth have an unfavourable ratio between the longitudinal axis of the crown and the root and a bipolar root system, as well. On account of this reason and due to the high load, the restoration of the lower first molars are fractured more frequently.
- With an equal volume of remaining dental tissue the retention of the restoration on the upper first molar is safer.

When restoring teeth with large hard dental tissue destruction we should consider:

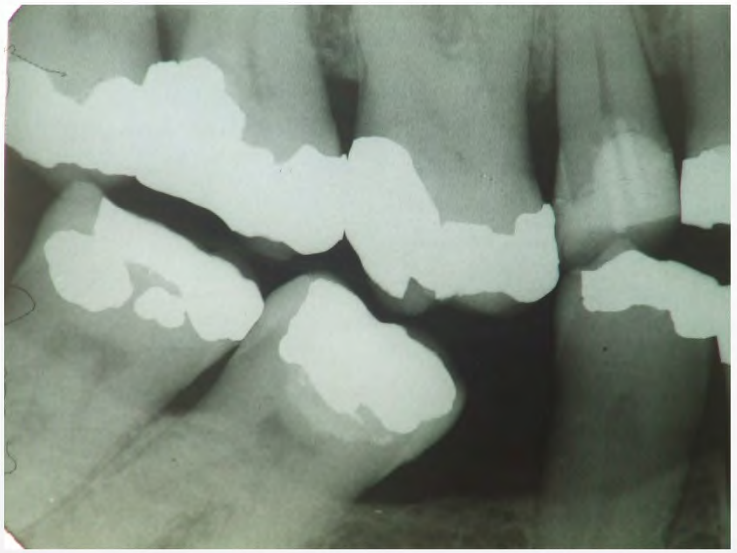
- The condition of periodontium and antagonists.
- The condition of interdental contacts.
- The presence of dystrophic changes to the dental pulp.
- Para-functions.
  - The masticatory forces are greater in individuals with well developed masticatory muscles, abrasion or para-functions. They pose a risk when restoring larger defects. The load is different in antagonists that are natural teeth, an irreplaceable denture or a replaceable one.

When restoring teeth with large hard dental tissue (HDT) destruction we should consider:

- The condition of the periodontium:
  - The masticatory load is passed and distributed most effectively in teeth with a healthy periodontium.
  - Depends on the degree of reduction of the tooth-bearing tissues and the discovery of the furcation. Such situations pose a risk of cement caries with subsequent pulp pathology.

When restoring teeth with large hard dental tissue (HDT) destruction we should consider:

- In case of disruption of the interdental contacts due to a large caries defect close by, the teeth begin to medialize. Conservative treatment is possible with a dental shifting of 1,5-2mm.
- In order to restore correct interdental contact, it is necessary to cut out the buccal and lingual edges of the proximal cavity of the medialized tooth.
- Indirect inlay/onlay recovery is recommended.



When restoring teeth with large hard dental tissue (HDT) destruction we should consider:

- Dystrophic dental pulp changes, reactive dentin formation and reduced pulp chamber volume are advantageous for providing retention and use of retention devices.
- Biological treatment is not suitable for teeth with severely damaged crowns

- Mechanical treatment of dentin in deep caries leads to altered demineralized or hyper-mineralised dentin; to normal healthy or tertiary peripular dentin.
- Reduction of the number of odontoblasts, aspiration of the odontoblasts nuclei to grow, located in the dentin tubules.
- In advanced caries - in the odontoblastic layer and the underlying ones - typical for the chronic inflammatory process cells appear - lymphocytes, macrophages, plasmatic cells.

- Deep caries are histologically characterized by an inflammatory infiltrate in the dental pulp.
- Bacterial toxins and enzymes penetrate the dentinal tubules.
- There are no clinical manifestations of pulpal inflammation.
- Removing the smear layer to improve adhesion of restoration materials to the cavity walls, influence the inflammatory process in the dental pulp, stimulate its plastic function.

- For large restorations, it is needed to predict the risk of developing secondary caries in accordance with the individual predisposition to caries, the location of the obturation and the type of restorative material.
- Restoration should provide precise occlusal-articulation ratios, not cause blockages or induce occlusal trauma.