

Lect 14 *New approach in restorative dentistry*

Traditional dental restoration was based on the principle created by G.V. Black in 1908, removing a lesion by operation and then restoring the damaged part. Modern material science proved that dental restoration material could not match the healthy dental tissue in terms of physical, mechanical, and biological properties. Removing healthy dental tissue and restoring the cavities with traditional filling material certainly could not meet the functional requirements.

In the twenty-first century, modern dentistry suggested a more reasonable theory, which was minimally invasive treatment; other terms were used such as minimal intervention dentistry, minimally invasive dentistry, and micro dentistry. Minimal intervention dentistry focuses on the knowledge of how caries develop, including early diagnosis, prevention, and treatment, and placed emphasis on the treatment switch from dental operation to biological method, to prevent the development of dental caries and preserve as much healthy dental tissue as possible.

They focus on the preservation of healthy dental tissue when removing caries lesions, instead of the “extend to prevent” principle of G.V. Black

In terms of the biological study of dental tissue, in addition to the etiology of caries, especially the process of remineralization, the revolution of diagnosis measurement, and the novel view of prevention, the development of dental material has laid the foundation for minimally invasive dentistry as dental caries treatment has shifted from dental surgery to biological treatment.

Four basic principles for was proposed for minimal invasive dentistry:

- lesion control
- remineralization of early caries
- minimal surgical trauma
- restoration.

Modern caries treatment pays more attention to the

- biological response of the pulp–dentin complex
- to the relationship between the restored tooth and periodontal health
- between occlusion and periodontal health
- proximal contact between the prosthetic and the adjacent teeth

Minimally Invasive Treatment Technique

Minimally Invasive Cavity Preparation

The cavity can be roughly divided into two layers from outside to inside:

1. Infected layer: this layer of the tooth structure has been completely denatured and bacteria settled.
2. Demineralized layer: this layer has a certain level of demineralization, but the collagen scaffold still exists and can be re-mineralized. In the past it was thought that the demineralized layer should be removed, but now they suggested that the demineralized layer is a precarious status instead of caries-active status, this layer can be remineralized. Therefore, the modern view is that the removal of diseased tooth structure should be limited to the infected layer (minimal surgical intervention) by new technologies including *sandblasting caries removal*, *LASER*, *chemical–mechanical caries removal*, and other, all these have overcome the excessive loss of the healthy tooth structure caused by traditional dental drilling.

Non-machinery Preparation

➤ **Air Abrasion** The principle of air abrasion is to apply highly pressurized, nontoxic particles, such as aluminum oxide ions, to accurately remove the enamel, dentin, carious tissue, and old fillings. Air abrasion can partially replace the high-velocity gas turbine cavity preparation. It is quieter, more time- and energy-efficient, and requires no anesthesia as it does not produce vibration and heat. It is well received by patients and maximizes the conservation of the tooth structure. The interior of the prepared cavity is smooth, making it easier to fill. It reduces the likelihood of micro-fracturing.

The disadvantage of this method is that because it is easier to remove dentin than enamel, it causes the overhang of enamel, which requires trimming of the enamel with the drill.

Contraindications to air abrasion include patients with:

1. A severe allergy to dust, asthma, and chronic obstructive pulmonary disease.
2. Open wound or recent tooth extraction.
3. Active periodontal disease.
4. Recent placement of an orthodontic appliance
5. Subgingival caries

↪ **LASER**

The ideal laser should be able to manage both dental hard and soft tissues. Clinically used lasers that can cut through dental hard tissues, all types have selective abrasive properties whilst conserving healthy tooth tissue. Laser cavity preparation is precise, non-vibrating, has no smell, and does not require anesthetics. As lasers can seal dentinal tubules, they can also prevent hypersensitivity postoperatively. On the downside, the machinery is bulky and expensive, thus limiting its role in clinical practice.

↪ **Chemo mechanical Caries Removal**

Chemo mechanical caries removal (CMCR) uses chemical agents to soften the dental tissues before eliminating infected tissue. This solution causes the partial disintegration of the collagen in the cavity, accelerating the removal of dental caries, a hand tool can be used to remove the softened carious tissue. This method can selectively dissolve carious tissue quickly (around 30s), whilst not affecting any healthy dentin.

CMCR can effectively remove the smear layer of the cavity, reinforce the bond between the filling and the tooth, there is no noise, vibration or anesthetics, and patient acceptance is high. However, when compared with the high-velocity turbine, the operating time is longer and requires alternative methods to gain access to and repair some undermining caries.

The CMCR method should be first considered for the following patient group: root/cervical caries, coronal caries (especially deep coronal caries), caries located on the edge of the crown or bridge abutment, completion of canal preparation, those in whom anesthetic is contraindicated, especially needle-phobic patients, those with a dental phobia, and pediatric patients.

Preventive Resin Restorations treat suspicious fissure caries and provides a new approach to the treatment of fissure caries. Preventive resin restorations only remove the infected enamel or dentin at the lesions, according to the size of the caries, using etching technology and the resin material filling up the early fissure caries, and the occlusal surface coated with sealant. It is a preventive measures combined between pits and fissure sealing and fissure caries filling.

Because it does not use the traditional extension for prevention, only amount of carious tissue is removed and restored with composite resin or glass ionomer, then the pit and fissure caries without caries is protected by the sealant, thus preserving more healthy dental tissue, and is an effective method for preventing the further development of caries.

The advantage of preventive resin restorations is using glass ionomer composite resin as filling and binding with enamel mechanically or chemically, and then bonding with sealant by chemical bonding reduces the possibility of generating micro-leakage.

Remineralization Treatment

For early enamel caries that have been demineralized, the appropriate drug treatment to remineralize, is called remineralization treatment.

Early enamel caries on the smooth surfaces (buccal, labial, lingual, palatal or proximal), such as white spots, and people susceptible to caries are suitable for remineralization therapy. There are many types of mineralized fluid, which divided into single component and complex components. The single component is mainly fluorine-containing, the complex component mainly containing different ratios of calcium, phosphate, and fluoride salts, while calcium or fluoride salt is the main ingredient

In recent years, a new remineralization agent, casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), has been used clinically. CPP-ACP has a wide range of applications in biology, including the promotion of remineralization of the tooth surface and bone calcification, promoting the absorption of minerals, and has an effect on cariogenic bacteria.

Currently, CPP-ACP is used in the treatment of early caries remineralization, dentin hypersensitivity, dental erosion treatment, and as prevention in caries-susceptible patients. The remineralizing agent with CPP-ACP as the main ingredient shows broad application prospects in caries prevention.

Sealing over caries lesions

Clinicians are often concerned regarding the inadvertent sealing of surfaces that are already carious because of the possibility that sealed lesions will remain active. However they indicated that sealants can be considered a viable modality for *arrest* of pit-and-fissure caries, many studies have shown that carious lesions that are effectively sealed do not progress for as long as 3-5 years. When sealing incipient lesions, care should be taken to monitor their retention at subsequent recall/annual dental examinations. Sealed lesions generally become arrested because the microorganisms do not remain vital within the lesion and what bacteria remain are not capable of maintaining progression of the lesion in addition, the acid-etching process alone can reduce the bacterial load

Sealants for proximal enamel surfaces

Adhesive resins can be applied for sealing early carious enamel lesions on proximal surfaces in order to arrest their progression .The proximal sealant technique is likely to be suitable for the primary dentition as the progression of enamel caries into dentine occurs relatively quickly, and the timely placement of sealants can halt progression of the lesions. However, this technique may be hampered by the requirement for separation of the teeth prior to placement of the sealants that usually involves two appointments, so it is not practical for young children. An alternative method would be to seal the teeth while it is possible to gain access to the proximal smooth surfaces before the contacts with adjacent teeth are established, another disadvantage is the need for repeated radiographs at initial and periodic examinations to check for progression of the lesions