MINIMALLY INVASIVE TREATMENT IN DECIDUOUS TEETH DECAY

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Abstract

Dental caries is one of the most common disorders of childhood. Although preventable, it is found in large sectors of the pediatric population. In recent decades, focus was laid on the methods for its prevention, by controlling bacterial plaque, food diet and various methods of local or general fluoridation. On the other hand, developing of methods for early diagnosis of dental caries led to detection of the disease in its incipient stages. In the same time, there was a big breakthrough in the development of restorative materials, whose properties do not require removal of large amounts of substance to achieve retentive dental cavities. Thus, modern dentistry has proposed a more reasonable theory, called minimally invasive treatment.

Keywords: air abrasion, air polishing, ART, sono-abrasion.

The minimally invasive treatment refers to the preservation of tooth structure as much as possible, being a branch of conservative dentistry. In literature, terms such as minimally invasive dentistry and microdentistry are used.

Tyas et al. were of the opinion that minimally invasive dentistry is concentrated on how to approach tooth decay, including early diagnosis, prevention and treatment, focusing on changing treatments - from dental operational interventions to the biological methods of preventing the development of dental caries and preservation of as much sound tooth tissue as possible [1].

Peters et al. considered that minimally invasive dentistry focuses on preserving healthy tooth tissue by removing only the carious lesion, rather than the “preventive extension” developed by G.V. Black [2,3].

Regarding the study of the dental tissue, combined with caries etiology, especially the remineralization process, the revolution of diagnostic measures and the new perspective of prevention enabled the development of dental materials which set the basis for minimally invasive dentistry.

Tyas et al. proposed four basic principles for minimally invasive dentistry: control of the lesion, remineralization of early tooth decay, minimum surgical trauma and restoration, but not replacement of dental caries lesions.

The minimally invasive techniques involve:
1. rotatory mechanical techniques - involving burs
2. non-rotatory mechanical techniques - air abrasion, air polishing, ART, ultrasonic and sono-abrasion
3. chemo-mechanical techniques - cariosolv, caridex, enzymes
4. photoablation with laser [4].

In the following, the non-rotating techniques for minimally invasive treatment are enumerated. These techniques are used in the early stages of dental caries in people susceptible to tooth decay and caries prevention in the areas.

Air abrasion

Air abrasion is a pseudo-mechanical, non-rotating technique, used to remove decayed tissues. The air abrasion principle is to apply, under a high pressure, non-toxic particles, such as ions of aluminum oxide, to remove accurately the enamel, dentin caries tissue and old fillings. To adjust the action to the characteristics of the instrument, a number of parameters can be modified: type and size of the abrasive particles, particle speed, air pressure, distance between the instrument and the tooth surface, time of use [5].

Air abrasion is quieter and more efficient in terms of time and energy consumption, it requires
no anesthesia, and does not produce vibrations and heat. It is easily accepted by the patient and maximizes the preservation of tooth structure. The interior of the prepared cavity is fine, making it easier to fill. It also reduces the stress between filling and tooth structure, possible microfracturing, thus prolonging the life of fillings.

The air abrasion system uses abrasive particles projected mainly for the affected area of the cavity. If the blackened area is a simple stain, it can be removed easily. If decay is accompanied by affected tissue, a strong jet of abrasive particles can remove both stain and the affected tissue. If dentin is wet, thick and elastic, the particles bind to the surface, making the device unable to exert its effects. Therefore, soft dentin should be removed manually. Another disadvantage of this method is that, because of an easier removal of dentin, comparatively with the enamel, the latter one should be removed by burs. Another disadvantage would be the total lack of tactile sensation, because the tool head does not touch the surface of the tooth. Therefore, the physician should be able to foresee the cavity limits before cutting, to reduce the high risk of its over preparation [6].

Recent studies proposed alternative abrasive particles, showing that software particles, such as polycarbonate resin or alumina hydroxyapatite mixtures can be more selective in removing carious dentin, because they are capable of removing only tissue of equivalent hardness, the healthier tissue remaining unaffected [7].

**Air polishing**

Air polishing produces a high pressure jet which contains sodium bicarbonate; it is projected on the surface of teeth, producing a cutting/grinding effect. This technique was originally designed for removing stains. Air polishing is not very selective when grinding tooth structure and it can affect the health of dentin and cementum. It is used especially in the final preparation of the tooth to remove the remaining altered dentin. Air polishing is accomplished by the propulsion of abrasive particles through a mixture of compressed air and water, with a handpiece, thus removing stain and/or dental plaque [8].

The abrasion rate is influenced by speed, pressure, time of abrasion, shape and hardness of the particles used [9]. However, hardness and size of particles used are those that determine decisively pigmentation removal. Commercial preparations are divided into fine, medium or coarse. The doctor has the mission to determine what type of powder is best suited for natural areas and restorative materials.

There follows a set of information about air polishing supported by scientific evidence when using an air polishing powder with a Mohs hardness number of 3 or less:

- Air polishing removes the stain and dental plaque in half the time it would take using traditional polishing, while stain can be removed 3.15 times faster than with a curette [10].
- Air polishing is not painful if the air / water/powder stream is not directed on the soft tissues [11].
- Air polishing can be safely used on titanium implants, being the method of choice for orthodontic banded and teeth bracketed, preparation for sealant placement and bacterial removal from root surfaces [12].
- Air polishing can produce uniform smooth root surfaces and remove 100% of bacteria and/or bacterial endotoxins from cementum.

**ART**

A traumatic restorative treatment (ART) is an alternative treatment for tooth decay. It was originally developed for use in underdeveloped countries, in rural areas, because it requires no anesthesia or electricity. Recently, the increased interest in this technique was manifested in developed countries, because of its “atraumatic” approach in relation to the stress and pain experienced by patients [13].

The ART principles are:

1. Removal of carious tooth tissue using only hand tools
2. Restauration of the cavity with a high-viscosity glass-ionomer, along with concurrent sealing of the adjacent pits and fissures [14].

ART includes the absence of noise and vibration and reduces the need to administer anesthesia. Studies have shown that ART
restorations on one surface of temporary teeth have the same survival rates as those with amalgam. ART restorations on more surfaces of temporary molars have a shorter survival compared to those on a single surface [15].

**ART technique indications:**
- Very young children who have never been to the dentist
- Patients with anxiety / strong fear
- Patients with physical and / or mental disability
- High-risk caries clinics, as an intermediate treatment, to assure stabilization conditions [16].

The ART approach is very cost effective since it is a friendly procedure. It makes restorative care more accessible for all population groups [17].

**Ultrasonics and sono-abrasion**

The high frequency ultrasonic vibrations have been recommended since the 1950s to remove proximal carious lesions in both posterior and anterior teeth, with the aim of achieving a more conservative cavity preparation. This technique does not physically excise the dentin, yet it abrades it using a diamond-coated tip oscillating at a frequency of about 6.5 kHz, up to a maximum frequency of 20-40 kHz [18].

Recently, sono-abrasion has been developed as a modification of the original ultrasonic method. Sono-abrasion is a technique for the selective preparation of enamel and dentin, offering excellent efficacy, quality and safety [19]. It utilizes high frequency, sonic, airscalers with modified abrasive tips which describe an elliptical motion with a transverse distance of 0.08- 0.15 mm and a longitudinal movement ranging from 0.055 to 0.135 mm. These tips are diamond coated on the cutting side, cooled using water at a flow rate of 20-30 ml/min and operated by 305 bar air pressure for finishing cavity. Using different shapes of tips helps in preparing predetermined cavity contours, while also working well in removing the softened, carious dentin [20].

Advantages - The ultrasonic procedure has the advantage of minimizing or eliminating noise, vibration, heat and pressure. The use of the ultrasonic technique can modify the proximal preparation procedure in order to protect adjacent teeth against iatrogenic damage caused by the use of dental burs. The disadvantages of this system are the relatively low abrasion and high hub excursion (0.4 mm) of the tips, and weakening of the enamel rods with the associating cracks adjacent to the prepared sites [21,22].

With the development of modern restorative procedures, dentistry engages in a new era. Dentists have a responsibility to upgrade the praxis from maximal to minimal interventions. The minimally invasive treatment of dental caries offers the potential for a more conservative approach and also provides a patient-friendly treatment option.

**References**