

PRACA POGLĄDOWA  
REVIEW ARTICLE

## REVIEW OF TREATMENT METHODS OF PATIENTS WITH UNCOMPLICATED TEETH FRACTURES

### ANALIZA OPCJI TERAPEUTYCZNYCH U CHORYCH Z NIEPOWIKŁANYM ZŁAMANIEM ZĘBA

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#### ABSTRACT

**Introduction:** Taking into consideration the high prevalence of dental trauma, the issue dental trauma management in the frontal dentition is relevant, considering the principles of biological, economical feasibility and clinical features of each case.

**The aim:** The purpose of this review article is to draw dentists' attention to the high prevalence of uncomplicated fractures of teeth (without pulp chamber exposure) and to highlight the most effective methods for their management.

**Materials and methods:** We have processed about 50 scientific sources devoted to the treatment of traumatic lesions of teeth. Among them are articles, scientific researches, clinical cases, laboratory researches.

**Conclusions:** The most appropriate method for teeth restoration in a case of uncomplicated fracture is to preserve the fragment of the tooth with its further reattachment applying an adhesion protocol with the preliminary preparation of hard tissues of teeth. To achieve the best aesthetic results and increase the endurance of restoration it is expedient to cover the repartitioned fragment of a tooth with ceramic veneers.

**KEY WORDS:** dental trauma, reattachment of teeth fragment, ceramic veneer

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## INTRODUCTION

Nowadays, traumatic lesions of teeth is a frequent reason for a visit to a dentist among adults. Statistics varies slightly from country to country but the general trend can be clearly seen. Anterior teeth are the most often affected, especially central and lateral upper incisors. For example, Iranian studies have shown that the frequency of appeals to dental service because of dental injuries reaches 37.5% of all cases. About 74% cases of dental traumatism belongs to maxillary central incisors (32% to right central and 42% to left central, 8 % to maxillary distal (4% both left and right), 6% to mandibular centrals (2% of left and 4% of right ones) and 12% to combined types of fractures (10% to fractures of both maxillary central incisors, and 2% - to fractures of both mandibular central incisors). [1].

Similar results have received Hedge and Sajani during their research on the territory of India [2]. The frequency of traumatic lesions of maxillary central incisors was 71.4%, maxillary distal incisors – 11.6%, mandibular central incisors – 11.3% and maxillary canines – 5.65%.

Another data shows that the prevalence of permanent teeth traumatism in Europe is 29.5% [3, 4, 5, 6, 7], in Asia – 25.8 % [8], in Africa – 15.4 % [9, 10], in the Middle East – 14.5% [11, 12, 13, 14], in North America – 24.7 % [15, 16, 17], in South America – 30.4% [18, 19, 20].

Traumatic lesions of hard tissues of teeth and pulp are represented by the following groups of WHO classification:

1. Crown infraction (an incomplete enamel fracture without tooth structure loss)
2. Fracture of enamel (incomplete tooth crown fracture). The fracture of enamel with tissue loss.
3. Enamel & dentine fracture (incomplete tooth crown fracture). The fracture with the loss of enamel and dentine without the pulp exposure.
4. Complicated crown fracture (a fracture of enamel and dentine with pulp exposure).

Various sources report about that among all variety of traumatic lesions fractures of crowns within the enamel on average occur in 17.4% of cases; uncomplicated enamel & dentine fractures (without pulp exposure) appear in 36.7% of cases, and fractures with pulp chamber exposure happen in 11.3% of cases [21, 22, 23, 24]. In different sources information on the prevalence of dental trauma among different age groups is rather diverse and sometimes quite controversial [22]. Certain authors report that in adulthood the peak of injury belongs to the age groups from 30 to 49 years. On the contrary, some other studies [25, 26] show that 71% to 92% of dental injuries happens in the age up to 19 years old.

There is an evidence that men suffer from traumatic

injuries of their teeth more often than women, with the proportion of 1.8: 1 [27].

Ulf Kleodor in his 12-year review says that the activity, society, and surrounding circumstance play a much more important role in the aetiology of dental trauma rather than gender [28].

Some other researchers involved in the study of dental trauma, agree that the most frequent aetiological factor falling and domestic injuries, road accidents take the next place, then acts of violence and sports injuries [29].

In percents 39% of all cases belongs to falling, 16.4% to sport injuries, 12.3% to injuries from collisions and manifestations of aggression, and 11.3% to the road accidents [30, 31, 32, 33].

According to the aforementioned data [22], resin based composite restorations are the most commonly used (24.9%) method of treating dental traumatism. Orthopedic methods are used in 20.3% of cases. However, it should be noted that in almost one third of cases (36.6%) none of the methods of treatment is used, and in 6.2% of cases dental treatment was limited to polishing of sharp edges.

Taking into consideration the high prevalence of dental trauma, the issue dental trauma management in the frontal dentition is relevant, considering the principles of biological, economical feasibility and clinical features of each case.

## THE AIM

The purpose of this review article is to draw dentists' attention to the high prevalence of uncomplicated fractures of teeth (without pulp chamber exposure) and to highlight the most effective methods for their management; визначити їх недоліки та переваги; вказати їх клінічну ефективність та порівняти застосування консервативних методик лікування із ортопедичними (зокрема, із керамічними вінірами).

## MATERIALS AND METHODS

Writing this review article, we have processed about 50 scientific sources devoted to the treatment of traumatic lesions of teeth. Among them are articles, scientific researches, clinical cases, laboratory researches.

## REVIEW

### CONSERVATIVE METHOD (POLISHING)

Frequently the effects of dental injuries are not so significant that they may need serious interventions but still cannot be left without attention.

Indications: minor fractures (chipped enamel), uncomplicated fractures (enamel and dentine) of deciduous teeth [35].

Technique: using low abrasive bur and polishing systems sharp edges that can injure oral mucose should be smoothed, apply desensitizer applications.

Advantages: low invasion, fast method, simplicity.

Disadvantages: aesthetic parameters can be reduced in the anterior dentition, risk of hypersensitivity.

### REATTACHMENT OF THE TOOTH FRAGMENT

Advantages: preservation of natural color, brightness, shape, texture of the tooth, fast (single visit) and relatively cheap method, the degree of wear of the bonded fragment is less than the degree of composite wear, preservation of usual occlusive relations.

Disadvantages: a need in periodic monitoring, risk of color changing of the bonded fragment, difficulties in «endurance» prediction [35]. Regardless the technique, the operating field should be isolated with a rubberdam to prevent moisture leakage and contamination. Surfaces should be cleaned with microabrasive materials (eg, pumice powder), etched with 37% orthophosphoric acid (15-30 seconds).

Protocols of dental trauma management:

- «Simple bonding» technique  
After etching an adhesive system should be used then the fractured fragment of the tooth should be fixed on a dual curing composite cement (the strength in the vestibular-lingual direction in this case is only 7-8 MPa that will make approximately 45.5% of the primary strength of teeth structures), if which is normally 16.5 MPa in vestibule-lingual direction in unaffected teeth).

- Bonding with modification of hard tissues of teeth  
Methods of teeth surface preparation:
  1. With an internal dentine groove. Preparation of this groove and its filling with resin-bases composites I can strengthen the tooth and modify its color according to the properties of the material [36], [37].
  2. With an enamel bevel. Creation of a bevel, both circular [38] and tongue [39], allows to increase the area of the etched enamel and, accordingly, the retention surface.
  3. With an internal V-shaped enamel groove. Although there is data on the usage of this technique in combination with resin-bases composites its clinical performance remains questionable if take in consideration the thickness of the vestibular enamel layer of anterior teeth [40].
  4. With an external chamfer. This technique in contrast to the above mentioned can be performed already after the procedure of adhesive fixation of the fragment if the fracture line remains visible. This technique could be performed circularly or from vestibular, or lingual side [37, 41].
  5. Overlapping technique. Also can be used in cases of visibility of fracture line after adhesive fixation of the fragment. The essence of this technique lies in the preparation of enamel surface layer with a width of about 5 mm and depth of 0.3 mm and the covering of the prepared surface with a resin-based composite. This technique is often used in practice, but has a disadvantage in the darkening of resin-based composite over time [42].

The methods described above help to achieve on average 97.2% of strength of the reconstituted complex that is very close to to the natural hardness of the hard tissues of the teeth (approx. 13.7 MPa).

Sometimes doctors combine the techniques of preparation. [43, 36].

## METHOD OF DIRECT COMPOSITE RESTORATION

The broken fragment is not bonded to its place, but replaced with a light-curing resin-based composite material.

Normally direct restoration allows to restore up to 95.8% of tooth strength (approx. 15.8 MPa). This technique can be performed in a single visit and relatively cheap, however all light-curing resin-based composite materials have such disadvantages as colour change and luminosity loss. Also they may require periodical polishing.

## REATTACHMENT OF A TOOTH FRAGMENT WITH A CERAMIC VENEER COATING

This technique allows to achieve strength within the range of 17-21 MPa (approx. 115% strength). Application of this technique allows achieving perfect aesthetic results and stability. However, this method requires 3-4 clinical visits and more expensive than direct restoration.

## COMPOSITE RESTORATION IN COMBINATION WITH CERAMIC VENEER

Strength in the vestibular-lingual direction is 20-21 MPa (approx. 124% of normal tooth strength). Application of this technique is rather disputable. Due to different coefficients of thermal expansion and absorption between light-curing resin based composites, dental ceramic materials the stability of this complex rests questionable [44].

## REPLACEMENT THE BROKEN FRAGMENT OF TOOTH WITH A MASSIVE CERAMIC VENEER.

The strength in vestibular-lingual direction is 27-28 MPa (approx. 167% of strength) [44,45].

## VITALITY OF PULP IN CASES OF DENTAL TRAUMA

It should not be mentioned that dental traumatism often affects not only hard tissues of teeth but also periodontium. The traumatization of periodontium as well as apex closure raises a serious question of pulp survival, which, makes adjustments to the protocol of treatment (possibility of endodontic treatment). Generally, many doctors are unanimous in the opinion that treatment prognosis is the best in the case of injury to the hard tissues of the teeth rather than in the luxated teeth, especially if the issue relates to the sensitivity of the pulp [46, 47, 48]. According to Atabek, periodontal and hard tissues injuries are found in 17.6% of the cases and the incidence rate of injuries with unclosed tooth apex is 30.88%. Preservation of pulp vitality directly depends on the following factors: root formation, presence of periodontal injury, as well as the time of delay between the trauma and the visit to clinic. [49]. The aforementioned author in his study indicates that in 68 cases of uncomplicated fractures the pulp remained vital in all cases, regardless if the periodontium was injured or not, mentioning that the tooth apex remained unclosed. In the case of injuries of hard tissues of teeth with closed apex in combination with the dislocation of tooth, the pulp rested vital in 14.3% of cases.

According to Moule et al., the risk of pulp necrosis with uncomplicated dental injuries varies from 0 to 3.5% and increases to 25% if combined with luxation. The risk of pulp necrosis is the highest in deep angular fractures, especially if the visit to the doctor was delayed on more than 24 hours. [50]. The authors recommend endodontic treatment only in the cases of obvious signs of pulp necrosis or irreversible pulpitis, but it should be noted that sometimes clinical observations of this fact can be extended even for a year.

## CONCLUSIONS

For the best results each stage of restoration protocols must be thoroughly executed. Isolation of the operating field is an important factor in maintaining the strength of adhesion, as moisture leakage significantly affects the strength of adhesive fixation. Also an important factor for augmentation of bonding strength is the creation of micro-retention (pumice powder, etching) and macro-retentional points on the surface of teeth (bevels, grooves, chamfers, etc.). The most effective techniques of preparation were the overlapping technique and the internal groove preparation (97.2% and 90.5% respectively) [36, 44].

Teeth restored with massive ceramic veneers are characterized by increased rigidity and reduced stress resistance, but according to the literature no problems are observed if the volume of ceramic mass remains moderate (replacement of the incisor edge up to 5.5 mm in vertical dimension) [45].

Although the usage of resin-based composites in combination with ceramic veneers improves elasticity of tooth structures and allows the veneer to be shifted to the incisal zone, their application remains questionable due to differences in thermal expansion and hydroscopicity of composite materials in comparison to ceramic and hard tooth tissues. These differences raise the question of the stability of «tooth-composite ceramics» complex if the thickness of resin-based composite material prevails over ceramic or in the case of its coverage with ceramics [45].

After having analyzed different techniques and results of researches, we can conclude that the most appropriate method of restoration of uncomplicated teeth fractures is the preservation of the fractured fragment of the tooth, followed by its reattachment using the adhesive protocol accompanied by the preliminary preparation of hard tissues of teeth. Affirming this fact, we rely on the factors of biomimetics and physical and mechanical properties of teeth structures and restoration materials. In order to achieve the best aesthetic parameters and increase the endurance of restoration it is expedient to cover the repartitioned fragment of teeth with ceramic veneers. Great attention should be paid to additional factors (apex closure, delay of visits, trauma of periodontium).

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