PRELIMINARY CLINICAL-STATISTICAL STUDY REGARDING POSTOPERATIVE SENSITIVITY IN THE TREATMENT OF SIMPLE CARIES

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Abstract: *After the usual treatment of simple caries, an unpleasant complication occurs quite often, namely postoperative hypersensitivity. The aim of the paper is to draw attention to this complication that is rather frequent yet little known by the dental practitioner. There are a lot of clinical manifestations of this disorder that has different etiological factors and production mechanisms. The method consists of the examination of 104 patients of both sexes in the 23-40 age bracket, who came to "Carol Davila" University of Medicine and Pharmacy in Bucharest to have their simple caries treated, and who were monitored for a period of 3 months after the treatment. We studied only the occlusal carious lesions in the molars that were restored using composite materials. The examination of patients was performed using a questionnaire that included a clinical examination, the patient's subjective account regarding the presence of postoperative pain, the depth and extent of the preparation, the restoration status, the sensitivity to cold stimulus and the tactile one, assessed by the examiner, the duration and intensity of pain, all scored on a scale from 0 to 3. The results of the study are systematised and the discussions on the results consider the data from the literature. The conclusions highlight the variety of postoperative pain clinical manifestations, as well as the pain dependence on a number of individual factors, as well as on the cavity depth and the observance of proper preparation and restoration techniques.*

Cuvinte cheie: *sensibilitate dureroasă postoperatorie, scorul durerii, profunzime, tipul durerii*

Rezumat: *După tratamentul uzual de carie simplă, apare destul de frecvent o complicaţie neplăcută, cunoscută sub numele de hipersensibilitate dureroasă postoperatorie. Scopul lucrării este acela de a atrage atenţia asupra acestei complicaţii destul de frecventă şi de puţin cunoscută de către medicul dentist. Această afecţiune prezintă o varietate de manifestări clinice, factori etiologici diverşi şi mecanisme diferite de producere. Metoda de lucru a constat în examinarea unui număr de 104 pacienţi de ambe sexe şi vârste cuprinse între 23-40 ani, care s-au prezentat pentru tratament de carie simplă în cadrul Universităţii de Medicină şi Farmacie „Carol Davila" Bucureşti, urmăriţi fiind pe o perioadă de 3 luni de la efectuarea tratamentului. Am luat în studiu doar leziuni carioase cu localizare ocluzală la nivelul molarilor, aceştia fiind restauraţi cu materiale compozite. Examinarea pacienţilor a fost efectuată prin chestionar, care a cuprins un examen clinic, privind relatarea subiectivă a pacientului, cu privire la prezenţa durerii postoperatorii, profunzimea şi întinderea preparaţiei, starea restaurării, sensibilitatea la stimulul rece şi cea tactilă efectuată de examinator, durata şi intensitatea durerii, toate evaluate după un scor de la 0 la 3. Rezultatele studiului au fost sistematizate în studiu, iar discuţiile asupra acestora au luat în considerare date din literatura de specialitate studiată. Concluziile au evidenţiat varietatea manifestărilor clinice ale durerii postoperatorii, dependenţa sa de o serie de factori individuali, de profunzimea cavităţii şi respectarea unei tehnici corecte de preparare şi restaurare.*

INTRODUCTION

Dental pain may be dentinal, pulp, and periapical, being transmitted by the nerve fibres in the pulp tissue. Pain has two major characteristics as follows:

- it is objective, quantifiable, and sometimes associated with neurological-vegetative manifestations;
- it is subjective, impossible to measure, each patient having the own way of perceiving pain.

We can thus speak of an organic and a psychological component of pain.(1)

Dentinal pain or sensitivity is associated with all the manoeuvres, be they instrumental or not, performed by the dental practitioner on the dentinal tissue, or when this tissue is exposed to the oral environment because of various reasons (traumatism, abfraction, attrition, abrasion, erosion, periodontal disorders). Although often unnoticed, pain can become annoying and alarming over time, being complicated by pulp disorders.(1)

Postoperative hypersensitivity is a condition that occurs following apparently correct restorative treatments, physiognomic restorations, and especially composite resin restorations. It has a high incidence and its treatment often poses problems.(2)

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Dentinal pain morpho-physiological substratum

The explanation of the postoperative dental pain etiopathogenic mechanisms is given by the structure of dentin and the complexity of its relations with the pulp tissue.

Dentin, a hard dental tissue, consists of a multitude of primary and secondary dentinal tubules, which are rigid and sinuous, and whose diameter decreases from the pulp area to the enamel-dentin junction. The capillary action is present in them as in all rigid tubes that have a small diameter.

Inside each dentinal tubule, there are extensions of odontoblast (Tomes fibres), which react to physiological and pathologic stimuli, collagen fibres from the pulp, Aδ nerve fibres in the pulp ⅓ and dentinal fluid, filtered blood plasma like any other filtered blood plasma in the body, where the albumin/globulin ratio is the same with the one in the plasma. It has a hydrostatic pressure of 30 mm Hg.(1,3)

Dentinal pain is caused by the centripetal and centrifugal movement of the dentinal fluid in the dentinal tubules, when dentin is exposed to various local stimuli. The pressure variations on the restoration surface caused by different stimuli such as tactical, thermal, osmotic, chemical ones can determine the movement of the intra-canal interstitial fluid at a speed of 2-3mm/sec so that each tubule that is emptied by its fluid can be refilled in approximately 1 second, movement that is susceptible to generate pain, following the stimulation of the nerve fibres in the tubules (Brännström theory). Dentinal fluid serves as a transducer for the local stimuli to the sensory nerve endings in the dentinal tubules pulp end.(3,4,5)

Clinically, we can distinguish the following:(6)

♦ Objectively, it is noticed a physiognomic or non-physiognomic crown restoration that is apparently correctly performed through direct or indirect methods.

♦ Subjectively, pain occurs almost immediately postoperatively and lasts for several weeks or months, being translated into:

- immediate/tardy sensitivity to thermal, chemical, mechanical and other stimuli;
- sensitivity at the moment of habitual occlusion;
- spontaneous pain;
- temporary sensitivity to occlusal pressure, potentially correlated with a chronic periapical lesion that is radiologically detectable.

Postoperative sensitivity differs depending on several clinical criteria as follows:(2,7)

- the type of restorative material used;
- the age of the patient;
- the location of the carious lesion to be treated;
- the depth of the carious lesion (superficial, moderate or deep caries);
- association of favouring factors (occlusal trauma, remaining dental tissue improper acid etching, restorative material incorrect adaptation);
- different severe general conditions (AIDS, syphilis, tuberculosis, cancer, psychic disorders etc.).

Aetiology.(2,6, 7,8) Among the etiological factors of postoperative dentinal hypersensitivity, the following can be mentioned:

- excessive drying of the dentin wound by the excessive use of the air spray during the cavity cleaning stage, which determines the adiabatic distension of the dentinal surface, the evaporation of the dentinal fluid and the movement of the intra-canal fluid;
- during the restoration stage, following the application of adhesive resin, it is contracted by polymerisation, which adds to the fluid movement mentioned above;
- by the marginal infiltration process, the restorative material adhesion to the preparation walls is poor, because of incomplete/excessive drying, a process of contamination with saliva of the dentinal wound, or improper acid etching;
- when in the composite resin restoration the resulted micro-gaps do not reduce over time, as in the case of amalgam, and the existence of the gap is not evident in the early existence of the filling, the preparation is retentive and the material is retained mechanically, there are no objective initial symptoms of the deficiency.

♦ Micro-cracks in the filling adjacent enamel whose occurrence can be caused by:

- the intervention during the surgical preparation of the cavity;
- the inappropriate boarding of the unsupported enamel edges;
- the wrong guidance of the material polymerisation contraction that results in the exposed wall overloading.

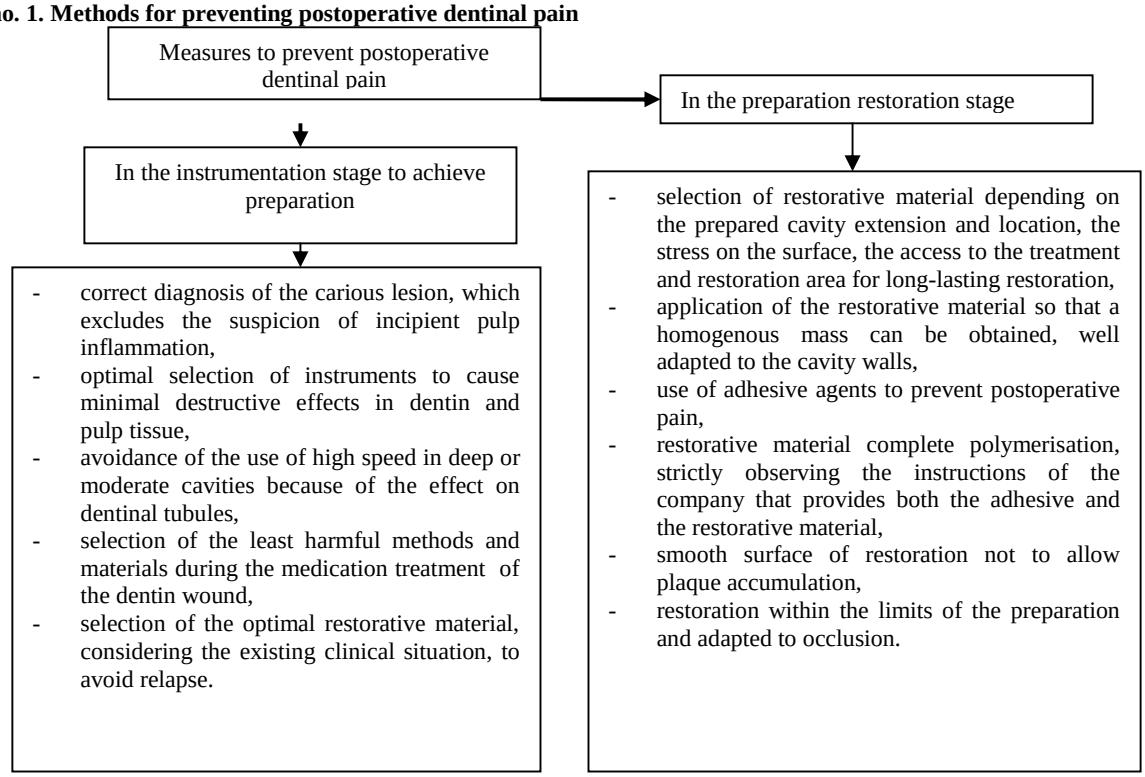
The prevalence of postoperative stress is less known and studied. In the pain occurrence mechanism, it is important the notion of pulp-dentin complex, which reflects the morphological and functional relationships between the 2 involved tissues. The stimuli cause changes in dentin as long as the tooth is vital. The interconnection between the physiological and pathological reactions in dentin and pulp entails the response to the cariogenic attack as well as to the therapeutic manoeuvres performed to treat and restore the affected tooth crown. Besides the relations between dentin and pulp tissue, there are also relations between dentin and the enamel and cementum that surround it.(8,910,11)

Postoperative pain does not occur in all the patients whose dentin has been instrumented, as pain depends on the permeability of dentinal tubules that, in turn, depends on a series of factors that are not covered by the present paper.

The treatment of postoperative dentinal pain is preventive and curative, depending on the clinical case. Preventive treatment is extremely important and available to any dental practitioner.(1,8,9) A brief overview of this type of treatment is presented in figure no. 1.

The dental restorative materials used in the treatment of carious lesions do not adhere to the walls of the preparation and, therefore, it is imperative to apply an adhesive agent to fill the space between the tooth and the restorative material, practically bonding both structures. The use of adhesive materials is aimed at maintaining, stabilising and fixing the restoration, as well as at the enhanced resistance of the tooth-restoration complex, eliminating the gaps between the two surfaces, diminishing marginal infiltration, preserving dental hard tissues, reducing dentin permeability and diffusion, sealing dentinal tubules, protecting the pulp-dentin complex and preventing postoperative sensitivity.(11)

Figure no. 1. Methods for preventing postoperative dentinal pain



It is also necessary to carefully analyse the given clinical situation and the properties of different types of adhesive systems, to elect a dentinal adhesive able to seal the tooth/filling interface and to preserve the pulp-dentin complex homeostasis by a correct approach to the remaining debris layer. The adhesion phenomenon is complex and depends on several factors that are not considered in the present paper.

METHODS

This paper presents the results of a clinical-statistical analysis carried out by us with regard to the prevalence and manifestation of postoperative dental pain, complication of the simple carious lesion regular treatment. The study was conducted on a group of 104 patients treated at "Carol Davila" University of Medicine and Pharmacy in Bucharest, and it was extended over a period of three months. The patients in the study were of both sexes and aged between 21 and 40 because we intended to exclude from the study the patients with reduced permeability of dentinal tubules as a result of age-induced structural changes. It is also the reason why we selected patients without general medical history or pharmacotherapy, thus avoiding the influence of the underlying disease on the pain threshold.

The study took into account, for uniform results, only the occlusal cavities located in the molar and, following an initial radiologic evaluation to exclude their chronic apical complication, the preparations for adhesive composite restorations were carried out.

The patients were examined using a questionnaire that included a clinical examination on:

- the patient's subjective account of postoperative pain;
- the preparation depth and extent;
- the restoration status (marginal and occlusal adaptation, integrity, surface appearance);
- cold sensitivity was estimated following the application of a jet of water at a temperature of 19-20°C, for 1 sec., using a standard syringe;
- tactile sensitivity was assessed using a rigid probe whose tip was bounced on the filling surface applying initially a small force that was gradually increased up the possible occurrence of pain;
- the duration and intensity of pain.

The examiners were always the same and they obeyed strict rules to eliminate possible false results. Adjacent teeth were isolated using the hand and/or cotton rolls.

The responses to cold and tactile stimuli were recorded in relation to the following scale:

- 0 – no response;
- 1 – discomfort yet not severe pain for a period of 1-2 days and up to 14 days;
- 2 – moderate pain in the presence of stimulus for 15-30 days;
- 3 – severe pain while and after the application of the stimulus for about 1-2 months.

The patients saw the dentist one day after they received treatment and, depending on the result, they were re-examined at intervals of several days, weeks or 1-2 months.

RESULTS

The results are presented below in percentage terms.

Following the carious process instrumentation, in the 104 patients, there were 43 (41.34%) superficial cavities, 34 (32.69%) moderate cavities, and 26 (25%) deep cavities. 47.11% cavities occur in patients in the 21-30 age bracket and 52.88% in patients in the 31-40 age bracket.

Depending on the type of response to the cold stimulus, made known by the patient and ascertained by the

examiner, the following data were obtained, which are recorded in table no. 1.

Table no. 1. Scores obtained following the cold stimulation of restorations

Score	Age	Superficial cavities	Moderate cavities	Deep cavities	Number	Percentage
Score 0	21-30 years old	20	15	7	42	40,38%
	31-40 years old	21	14	10	45	43,26%
Total		41	29	17	87	83,65%
Score 1	21-30 years old	1	2	1	4	3,84%
	31-40 years old	2	0	1	3	2,88%
Total		3	2	2	7	6,73%
Score 2	21-30 years old	0	1	2	3	2,88%
	31-40 years old	0	1	1	3	2,88%
Total		0	3	3	6	5,76%
Score 3	21-30 years old	0	0	2	2	1,92%
	31-40 years old	0	0	2	2	1.92%
Total		0	0	4	4	3,84%

As for tactile stimuli, the results were different, being presented in table no. 2.

Table no. 2. Scores obtained following the tactile stimulation of restorations

Score	Age	Superficial cavities	Moderate cavities	Deep cavities	Number	Percentage
Score 0	21-30 years old	21	15	10	46	44,3%
	31-40 years old	22	16	12	50	48,07%
Total		43	31	22	96	92,3%
Score 1	21-30 years old	0	1	0	1	0,96%
	31-40 years old	1	1	1	3	2,88%
Total		1	2	1	4	3,84%
Score 2	21-30 years old	0	0	1	1	0,96%
	31-40 years old	0	1	0	1	0,96%
Total		0	1	1	2	1,92%
Score 3	21-30 years old	0	0	1	1	0,96%
	31-40 years old	0	0	1	1	0,96
Total		0	0	2	2	1,92%

As for the duration of pain, it was assessed in the case of both types of stimulation as follows:

- for score 1, we considered the pain that lasted for a period of 1-2 days, 3-7 days up to 14 days for both types of stimuli;
- for score 2, we considered the pain that lasted for a period between 15 days to 1 month;
- for score, 3 we considered the pain that lasted for a period between 1 month and 2 months.

These data are briefly presented in figure no. 2 for cold stimulus and in figure no. 3 for tactile stimulus.

Figure no. 2. Duration of pain depending on cold stimulus

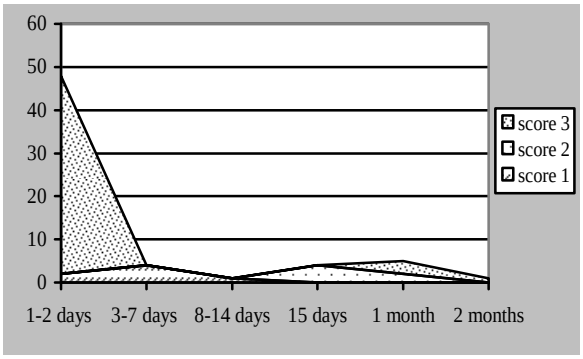
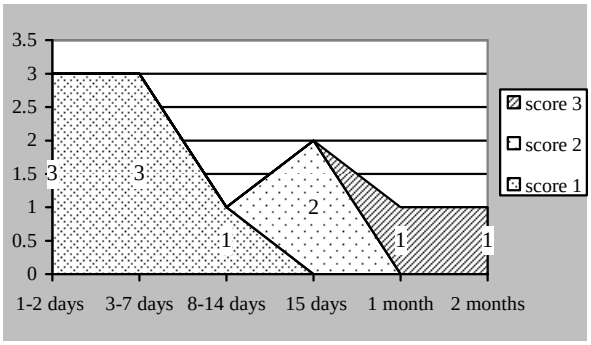


Figure no. 3. Duration of pain depending on tactile stimulus



We tried to establish, by a thorough clinical exam, the possible causes that led to the occurrence of postoperative pain and we found the following:

- 88 restorations (84.6%) were apparently correct;
- 5 restorations (4.80%) slightly over contoured in occlusion;
- 6 restorations (5.76%) with marginal fissures;
- 5 restorations (4.8%) with minor marginal fissures.

Mention should be made that this preliminary study was aimed at informing about the frequency of postoperative dental pain, the patient response after the application of cold and tactile stimuli, the pain duration and the clinical evaluation of its possible causes. Further research is needed in this regard, involving a larger number of subjects, all teeth, and different types of restorations, to obtain results that can lead to prevention measures.

DISCUSSIONS

Postoperative sensitivity clearly occurs as a complication of the treatment of simple caries. In the literature, it is recognised due to several subjective and objective clinical signs that have been mentioned before in the paper. However, the probable mechanism and causes

have not been fully elucidated. We can consider that the various clinical situations in which this complication occurs may be related to the cavity geometry (location and depth), the type of adhesive system used for restoration, the adhesion quality, the polymerisation technique, the type of restorative material and its bio-mechanical, physical, chemical and biological properties and, last but not least, the technique employed in preparation and restoration.(2,7,8) Among all these factors, the following have been analysed in the paper: depth of the cavity, pain occurrence following cold and tactile stimulation, pain duration, and restoration clinical aspect, all varying from one case to another.

The study conducted by us revealed the fact that, for the Class I caries restored using composite material, in 87 patients, representing 87.65%, pain did not occur following cold stimulation, and in 96 patients, in percentage terms 92.3%, pain did not occur following tactile stimulation. Their score was 0. It follows that only 17 patients (16.34%) had a positive response to cold stimulus, and 8 patients (7.8%) responded to tactile stimulus.

As for the depth of the cavity, it was observed that, for the cold stimulus, score 1, characterised by discomfort for 1-2 days up to slight pain for a period of up to 7 days, was attached to 3 patients with restorations in superficial cavities, 2 with moderate cavities, and 3 with deep cavities, and score 3 was present only in 4 patients with deep cavities. Following tactile stimulation, score 1 was attached to the restoration of 1 superficial cavity, 2 moderate cavities and 4 deep cavities, and score 3 to only 1 moderate caries restoration, and 1 deep caries restoration.

As far as the possible causes of postoperative pain are concerned, our study revealed that 88 restorations (84.5%) were clinically correct, in 5 restorations there was slight over occlusion, 6 restorations had marginal fissures, and in 5 restorations marginal fractures occurred, all 15 restorations representing 15.38% of the total of 104 restorations considered.

The fact that score 1, characterised by pain sensitivity that ranged from simple discomfort lasting for 1-2 days up to bearable pain lasting for maximum 14 days, was present in all types of caries, in percentage terms 6.73%, leads to the conclusion that it is directly related to cavities instrumentation technique or faulty restoration technique.

When the restoration was incorrectly adapted to occlusion, pain sensitivity lasted for 1-2 days up to 1 month and a half. In the case of moderate and deep caries it persisted even after the occlusal adaptation of the restoration for 14 days in 2 patients and for 1 month and a half in other 2 patients.

When fissures or minor marginal fractures occurred (2 in moderate cavities and 3 in deep cavities) postoperative sensitivity lasted for over 1 month, up to 2 months. Marginal fissures and fractures that can be considered to have been caused by faulty, brutal preparations that could result in initially unapparent marginal fissures in one of the preparation walls or by restorations that were incorrectly adapted marginally followed the marginal infiltration process.

The results obtained by us do not elucidate the causes of postoperative pain. However, they question the correctness of the manoeuvres employed by the dental practitioner while preparing the cavity, treating dentinal wound, or performing the restoration. A more comprehensive and thorough study, involving all types of restorative materials and all teeth, is necessary to draw a better informed conclusion.

CONCLUSIONS

Postoperative sensitivity is a complication of the simple caries treatment. It has different manifestations that are determined by various factors among which we mention the following: the depth of the cavity, the method used to instrument it, the restorative material and its physical, chemical and biological properties. It is important to observe the restorative material manufacturer directions related to the type of adhesion and insertion into the cavity as well as the type of polymerisation.

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