



HIDDEN CARIES - IATROGENESIS BY MISDETECTION

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Abstract: The hidden caries was initially described as dentin cavitory progressive lesions with healthy or minimally demineralized enamel that can be identified with radiographic investigations. Because of the initial clinical discreet evolution of this pathology, the subjective signs that draw patients' attention to the affected tooth appear only in advanced stages of dentinal destruction. Considering the fact that this caries is often detected by chance when radiologically investigating the neighboring teeth, there is a very high probability of detection in a highly advanced stage of evolution towards the dental pulp. The aim of this paper is to evaluate the clinical and statistical distribution of this pathology detected on 312 patients from both genders that came for treatment asking for a second opinion during a period of 5 years. An initial clinical examination was first accomplished for each patient who was also asked to answer to a questionnaire regarding his dental history. For each targeted tooth was performed a radiographic investigation and the radiographic results and the anamnesis data were noted in a treatment sheet especially designed for this study. The results of the study were finally gathered and they represented the basis for the discussions upon the causes that led to misdetection of these caries. The conclusions indicated that dentists' theoretical deficiencies in detecting and diagnosing this pathology always led to a wrong approach of the case and conducted to a non-realistic treatment plan.

INTRODUCTION

The references regarding this pathology begin with G.V. Black who presented in 1914 a large dentinal cavitation with small or none enamel access and Hyatt who mentioned a lesion that can evolve with great tissue damage starting from the base of a pit, fissure or groove without clinically detectable signs on dental surface.(1,2)

In 1986, hidden caries was described as cavitory lesions in dentin in teeth with clinically healthy or slightly demineralized occlusal enamel.(3)

The ICDAS II is a standard system for caries detection and assessment based on dental tissues status.(4,5)

In this system, the hidden caries is identified using a specific code that describes the visual dental changes that can be observed during a normal examination.

Code 4 is attributed to wet or dry dental surfaces with abnormal colored shadow (brown, dark brown, black or even grey) from carious dentin which can be observed through normal colored enamel.

Hidden or occult caries are lesions that can be visualized in dentin, mainly by means of bitewing radiographs that present progressive demineralization in dentin, which may progress and compromise the pulp-dentin complex.(6,7,8)

These lesions have often a silent progression and are usually not detected during superficial clinical examinations, based only on advanced visual or visual tactile detection techniques.

The detection and diagnosis of incipient caries in occlusal grooves and pits have always raised difficulties related not only to the individual dental particularities but to the accuracy of dental examination. In this way, it has developed, mainly, as an operator-linked issue.

Incipient detection is often impossible because the dentinal caries is radiographic visible only when the dentin is affected in a certain degree, and, in order to balance the tissues' destruction by caries' evolution, the treatment must be as conservative as possible.

The classical less conservative treatment versions based only on clinical detection implied a variable sacrifice of healthy tissues during the stages of accessing the dentinal cavitation and excision of irreversibly damaged enamel and dentin, in order to obtain proper visibility.(9)

The old concept of minimal intervention developed along with the adherent materials' evolution, the need for esthetics and a biological and a conservative approach during surgical intervention led to more conservative preparations.(10)

When treating hidden caries, the main problem is deciding whatever method or technique should be used and which are the factors that can affect in time the tooth's vitality or the longevity of the restoration.(11)

The trend for preservation of the health tissues in modern treatments is focused on downsizing the enamel access cavities and on selective excavation of the dentin with the complete removal of the necrotic one and total conservation of

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the affected dentin.

The management of hidden caries still requires complete removal for dental tissues that present a high degree of destruction or demineralization. In this way, the early detection gains great importance driving to a rational treatment decision related to the real caries' extension.

AIM

When managing a dental lesion, the most important part is to detect and diagnose it correctly, the proper selection of the treatment method being, in this way, approached.

Treating hidden dentinal caries implies, first, a general view of their particularities providing information on the real dentinal extent.

The aim of this study was to evaluate if a thorough examination can discover occult caries and what is the statistic distribution of this type of clinical situations detected on a group of patients, in a determined period of time.

The patients involved also asked for a second opinion and, so, this study intended to summarize what were the operator related reasons that can support this type of iatrogenesis.

MATERIALS AND METHODS

312 patients from both genders who initially were under dental treatment at different dental offices asked for a second opinion for dental treatment during a period of 5 years.

An initial clinical examination was first accomplished for each patient who was also asked to answer a questionnaire regarding the recent dental history.

The initial dental status was registered with digital images of visible dental surfaces of the posterior teeth that were attached to patients' treatment sheets, the data regarding the initial reasons for dental treatment requests being also recorded.

The clinical examinations were made on all teeth of each patient with a visual method by two consecutive examiners.

Teeth with occlusal abnormal inner colorations, free of restorations were spotted, even though those were not the reasons for initial presentation.

A digital bitewing radiographic investigation was performed for each suspected tooth after the clinical investigations and the results and the anamnesis data were recorded in the treatment sheet especially designed for this study.

The questionnaire that each patient was asked to fill in consisted in questions regarding the last dental examination and the reasons that drove to their decision of asking for a second opinion:

- type of examination (clinical/radiological);
- the type of radiological method (digital/classical, bite-wing/OPG) – if involved;
- the type of clinical method (visual/tactile) - if involved;
- the type of visual method (simple/ with visual magnifiers) – if involved;
- duration of examination;
- number of examined teeth;
- the existence of professional cleaning prior to the examination – if involved;
- the existence/type of moisture control during the examination – if involved;
- the time frame since the previous examination;
- the treatment plan proposed.

In all the clinical cases a similar examination protocol for caries' detection was used:

- the teeth were cleaned using rotary methods, with circular brushes and professional paste using a hand piece at

conventional speed to remove any extrinsic discoloration;

- a moisture control method was used;
- a separation with rubber rings method was used (when possible) to eliminate a proximal involvement;
- each occlusal surface of interest was dried for 5 seconds before the visual inspection;
- clinical examinations were made with a good standard illumination, a no 4 mirror and a standard pointed explorer (0,5 mm tip);
- an electric sensibility test was performed for each tooth, that confirmed their vitality at the moment of presentation.

The teeth were visually and tactilely evaluated by moving a sharp probe over the occlusal grooves and pits in order to detect any surface cavitation. The status was, then, recorded.

The visual examination searched for color changes (brown, black or grey seen through the transparency of the enamel and suggesting the existence of a dentinal cavity or demineralized white or brown enamel) and anatomical alterations (shape or dimension) of grooves and pits.

All radiographic examinations were made using the bitewing technique and the digital images were studied in standardized conditions.

After the diagnosis of occult caries for each case was confirmed, the patients were informed about the conservative treatment protocol, involving a minimally invasive approach and an adherent restoration.

For 295 patients (94,55%) the treatment plan involved a positive dental vitality conservation while, for the rest of 17 patients, there were discussions regarding the possibility of prolonging the treatment for maintaining a viable pulp.

Each case was discussed and the patient's consent for the suggested treatment was registered on the treatment sheet.

The differences or similarities to the initially suggested treatment were noted and underlined on the treatment sheet.

The carious lesions were accessed using a round carbide bur at conventional speed penetrating and removing the undermined occlusal enamel.

The necrotic dentin was sequentially removed with manual instrumentation using small excavators and a tactile control using a standard probe to assess the hardness of the remaining dentin.

The excavation stopped when no necrotic dentin could be removed any more with the probe even if affected juxtapulpal dentin had a modified color.

In all the cases, the treatment was made without anesthesia because the excavation had to be done with atraumatic technique focusing on patients' feedback regarding the intra-operative sensibility.

None of the teeth in this study needed endodontic therapy, even if most of the prepared cavities were deep.

In the deep cavities, the dentinal protection consisted in indirect pulp capping with calcium hydroxide as neo-dentinogenetic layer and resin modified glass ionomer cements (RMGIC) as base protective layer.

In medium depth cavities, a protective RMGIC layer was used.

In the cases with high risk of opening the pulp chamber with tooth vitality damage, step wise technique was performed.

The necrotic dentin was manually excavated during the first session completely from the lateral walls. The juxtapulpal wall was also approached with caution using manual instruments. The necrotic dentin was partially removed preserving the integrity of the pulpal chamber.

After cleansing and disinfecting (solution of chlorhexidine 2% for 1 minute) the affected/necrotic dentin,

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calcium hydroxide cement was placed on the juxta-pulpal wall as neo-dentinogenetic layer covered by a layer of resin modified glass ionomer cements also used as intermediate restorative materials (IRM).

There was one clinical check-up for testing teeth's sensibility and one radiological examination during the next 60 days, aiming the inspection of the juxta-pulpal wall thickness and the periapical evolution.

During the second session (60-90 days away from the first session), the IRM and the calcium hydroxide were removed followed by a total removal of necrotic dentin and a new indirect pulp capping treatment.

The occlusal adherent fillings were made with resin layering and cusp buildup restorative techniques, the resin cure being obtained by light curing with a LED device. The occlusal adjustment was made using rotative cutting instruments and articulation paper.

The outcome for each patient was recorded with a control radiographic image and a digital image of the clinical case with the adherent occlusal restoration.

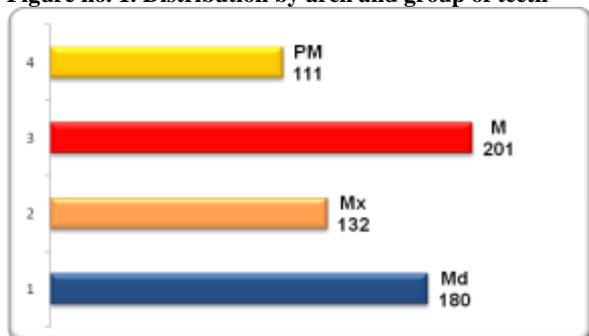
The patients were asked to come for a check-up after 14 and 30 days for those with long term indirect pulp capping (step wise technique) or 30 to 60 days for the rest (medium cavities or deep ones with one session of indirect pulp capping).

RESULTS

175 women and 137 males, with ages ranging from 15 to 40 years, presenting 312 hidden caries were treated in a private practice dental office in Bucharest by two experienced dentists during 5 years.

The distribution of occult caries on posterior teeth that needed treatment by arch and group of teeth is presented in figure no.1.

Figure no. 1. Distribution by arch and group of teeth



The distribution of hidden caries on the upper teeth is presented in figure no. 2 and the distribution on the lower teeth is presented in figure no. 3.

Figure no. 2. Distribution on upper teeth

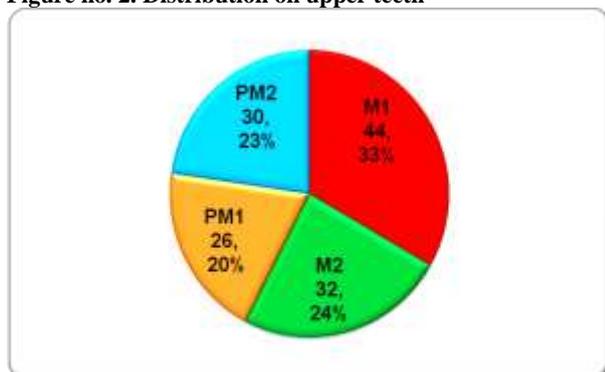
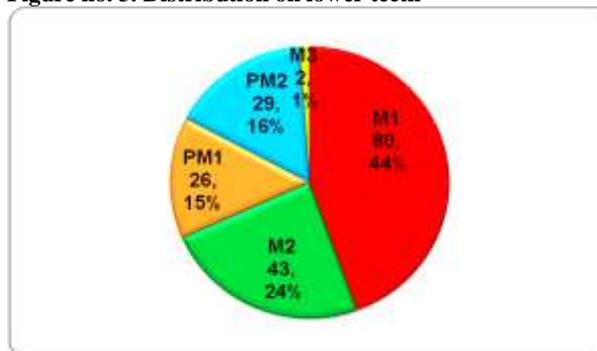
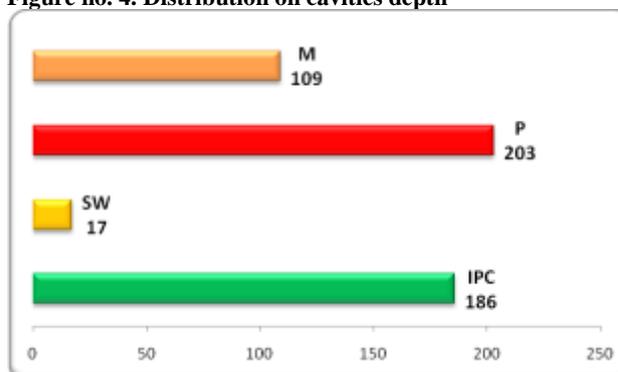


Figure no. 3. Distribution on lower teeth



The distribution by the depth of cavities obtained after the removal of the necrotic tissues of occult caries on posterior teeth and type of conservative treatment is presented in figure no. 4.

Figure no. 4. Distribution on cavities depth



The distribution by the depth of cavities after the removal of the necrotic tissues indicated that 203 (65%) of them were deep and 35% had a medium depth.

91,62% of the deep cavities with the indirect pulp capping (IPC) were followed by final adherent restoration in the same treatment session, while 8,38% of the situations implied the use of a step-wise technique (SW) based on long term indirect pulp capping (for at least 60 days) in order to preserve tooth vitality.

Data was collected and analysed from the 312 sheets and surveyed patients.

The examination was just clinical in 200 cases, the examination was mainly radiological in 62 cases and 50 cases were provided with both, clinical and radiological, examinations.

The 78 dentists that were conducting the treatment told the patients who received only clinical examination, that there was no need for a radiographic exam because, subjectively, there was no pain reported and, objectively, there was no sign of an obvious cavitation in enamel.

The 62 cases radiographically-investigated only, with none or limited clinical examinations, were diagnosed by 58 dentists. The absence of pain, of cavitation or a limited intrinsic discoloration were the main reasons why these dentists focused on radiographic examination.

The 50 cases with clinical and radiographic investigations were, in patients' opinions, at the same level (duration, type of clinical and radiological) with the ones conducted during both examinations.

When asked about the reasons for asking a second opinion, the patients answered that they were related to the treatment plan in terms of degree of invasiveness, duration and costs. 40 of them couldn't afford the treatment/accept the

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duration and 10 of them had considered that the suggested treatment looked too invasive.

The radiographic examinations used for the 112 patients were as follows:

- 70 bite-wings;
- 42 OPGs;
- 50 classical on film;
- 62 digital radiographic images.

The 112 radiographic images were viewed differently:

- 40 digital images on smartphones;
- 22 digital images on displays (laptop/desktop);
- 30 classical films on negatoscope;
- 20 classical films with not standardized source of light (ambient light/main dental lamp/solar light).

The clinical examinations used in 250 cases were as follows: only visual 130, only tactile 70, visual and tactile 50, simple visual 80 and with visual magnifiers 100.

The duration of examination varied from 5 to 15 minutes (accordingly with patients' estimation) for either clinical or radiographical method, and there was an average of 20 minutes for the combined examinations.

The examinations were made for a single tooth in 80 cases and for more than one tooth in 232 cases.

The clinical examinations were made on professionally cleaned teeth in 160 cases and the teeth were isolated during the examination in 180 cases.

As for the reasons for requesting a second opinion, the patients indicated lack of trust in the diagnosis or treatment (85), lack of trust in dentists' experience (105) and disagreements regarding the treatment proposed (122).

DISCUSSIONS

Based on the results obtained in this study, the hidden caries affected molars most frequently in comparison with the premolars, in a ratio of 1.81:1.(12-14)

Operators' limited access and visibility due to teeth posterior position combined with the complicated systems of pits and grooves that can be seen on occlusal surfaces create the premise on a failure in detecting incipient caries only by clinical methods.

The significantly greater prevalence of initially undetected dental caries in the lower than the upper arch (1, 36:1) sustains this idea.

During the second investigations, more hidden caries in female patients were discovered in comparison with the males, in a 1:1,27 ratio, suggesting women's greater attention to their dental health with a quicker response- searching for dental treatment when abnormalities were detected.

The main problems with the hidden caries are related to detecting and diagnosing based on a certain protocol.

Due to different training and experience of the examiners, the criteria used to diagnose these caries and methods of detection (both clinically and radiographically), the number of mis detected (undetected or incorrect labeled) hidden caries is impressive.(15-17)

136 (90%) from the 150 dentists who were considered not to be using a solid detection protocol, conducted to a misdetection, even if some correct elements were identified that had been used in the initial examinations, based on patients' questionnaires.(18-20)

In all these cases (262 patients), as stated by the patients in the questionnaires, the main diagnoses were dental necrosis, chronic dental pulpitis, idiopathic internal resorption, intrinsic and extrinsic discolorations and even recurrent caries although patients communicated that the targeted teeth had never been treated before.(21-23)

The 14 dentists that used the correct detection protocol

(based on clinical and radiological examinations) and identified correctly the hidden caries suggested, from the very beginning, a radical endodontic treatment, disregarding patients' symptoms and expectations.

CONCLUSIONS

The limited dentist's experience in detecting and managing hidden caries on posterior teeth shows a lack of theoretical knowledge on this pathology and can generally compromise any treatment, with negative implications on tooth vitality.

A wrong diagnosis can be generated using inaccurate, improper or just partially useful detecting methods. Thus, a dangerous situation for dentist and patient can occur with malpractice connotation.

The greater number of suggested treatment sessions with consecutively increased costs, usually forces the patients to ask for a second opinion that may be or not useful.

Conservative treatment should always start from a correct diagnosis of the lesions type and evolution, allowing accordingly the selection of the optimal therapeutic method.

An unprofessional conducted dental treatment has no realistic excuse considering that all the dentists from the study have graduated within the last 15 years, and, so, their information about the occult caries should be, at least, fresh if not updated.

Because of the silent pathology, early and precise detection of hidden caries is very important and implies a detailed clinical examination completed with bitewing radiographs.

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