

Romanian dentists perception about prevalence, diagnosis and restoration of dental caries on adjacent teeth. Part I

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ABSTRACT

Dental caries located on adjacent approximal tooth surfaces represent one of the most widespread clinical situations dentists encounter in dental practice. This article presents a cross-sectional study, using a questionnaire that was distributed to a number of 110 practicing Romanian dentists, regarding the prevalence, etiology, diagnosis and therapeutic approach of this kind of dental lesions. The results highlights that dentists knowledge and practice are up to date with the most recent diagnosis methods and therapeutic approach.

Keywords: dental caries, adjacent teeth, etiology, diagnosis, restoration

INTRODUCTION

Dental caries located on adjacent approximal teeth surfaces represent one of the most widespread clinical situations dentists encounter in dental practice, being located both in the frontal and posterior areas of the dental arches. They also have the common name of "mirror caries", and direct restoration is the treatment of choice. The high prevalence, as well as the problems related to the diagnosis and morpho-functional restoration of these substance losses, led to the idea of carrying out the present study in order to highlight the perception of dentists regarding the characteristics and challenges they represent.

METHODS

We carried out a cross-sectional study, using a questionnaire that was distributed to a number of

110 practicing Romanian dentists, regarding the prevalence, etiology, diagnosis and therapeutic approach of carious lesions on adjacent teeth. The questionnaire contains a number of 30 questions, of which 18 are with the possibility of choosing only one answer and 12 are multiple-choice. The questionnaire's questions were developed based on previous studies published. Participation in this study was voluntary, and written informed consent was obtained from all participating dentists. Of the 110 dentists invited to participate, 63 responded, giving an overall response rate of 57.27%.

In this article we present the answers and conclusions of the first 15 questions, related to the prevalence, risk factors, characteristics, diagnosis and treatment principles for this type of dental caries. The second half of the questionnaire focuses on the techniques, the used materials, the life

span or the causes of failure of the restorations made.

RESULTS AND DISCUSSION

1. The first question was related to the **age of the study participants** and had 6 possible answers representing age groups. This question has no relevance on its own, but only together with the rest of the questionnaire to be able to analyze certain practical knowledge and preferences for materials and work techniques resulting from personal experience. Based on all the data collected in this present study, we may say that there is a general trend towards new, regardless of age, which reveals that the dental field is in continuous development, and dentist tend to adapt in the light of continuing medical education, with the aim of offering patients the best possible treatment (Figure 1).

2. The second question was related to the **frequency of occurrence of carious lesions on adjacent teeth**, respondents having the possibility to choose on a scale from 1 to 5 how often they encounter this type of lesion in their daily dental practice.

In the table below, it can be seen that the most responses were for category 5, i.e. very frequently, in contrast to category 1, i.e. very rarely, which received no response. The weighted average calculated based on the table is 4.11. Analyzing all these data, we can conclude that this type of dental caries

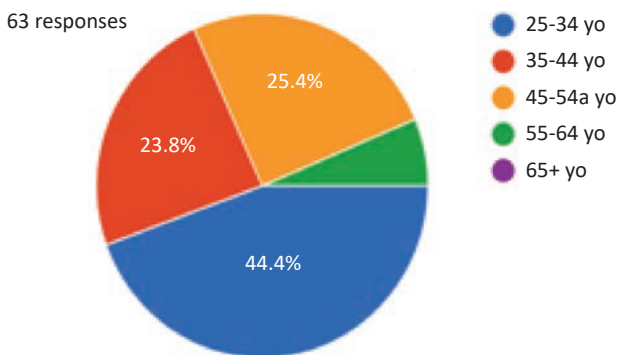


FIGURE 1. Division by age groups

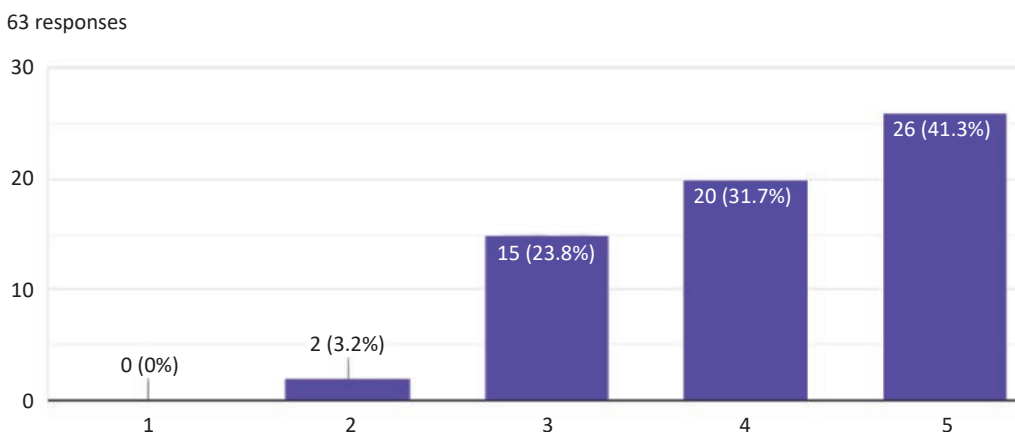


FIGURE 2. Frequency of carious lesions on adjacent teeth

has a very high occurrence in current dental practice, and that is why it is imperative to know the clinical characteristics and treatment for adjacent proximal tooth lesions (Figure 2).

3. The next question was related to the **location of choice for carious lesions on adjacent teeth** and had 6 answer options, multiple answers being possible. Each response option represented a contact area between two adjacent teeth. The question received 144 answers divided as follows:

- 26 answers for the approximate surfaces of the incisors (41.3% of respondents);
- 3 answers for the lateral incisor area – canine (4.8% of respondents);
- 3 responses for the canine area – first premolar (4.8% of respondents);
- 40 answers for the approximate surfaces of the premolars (63.5% of the respondents);
- 42 responses for the second premolar – first molar area (66.7% of respondents);
- 30 answers for the approximate surfaces of the molars (47.6% of the respondents).

Analyzing the data provided by the questionnaire we can see that most of the answers indicate the teeth in the lateral area. They present a much larger interdental contact surface that favors food and dental biofilm retention under the contact point and subsequently the appearance of dental caries [1]. Another problem of this area is represented by the posterior positioning of the teeth, which leads to a lack of direct visibility, thus creating both hygiene problems and early detection failures [2]. In the case of incisors, dento-alveolar incongruence is a common problem and a frequent cause of carious lesions in areas with close interdental contacts (Figure 3).

4. The following question was related to the **etiology** of this type of dental caries observed in personal practice in the dental office, with 3 possible answer options. Of the 63 dentists who responded to the questionnaire, 44.4% (28) considered that the main cause of carious lesions on adjacent teeth is

63 responses

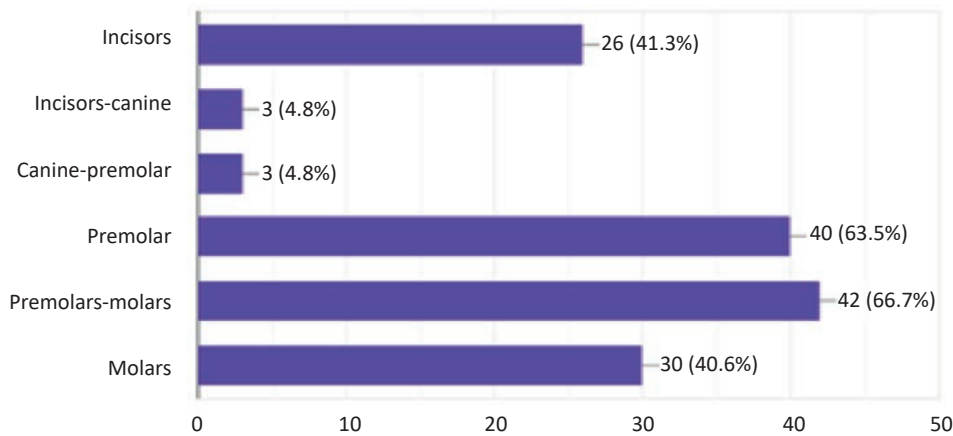


FIGURE 3. Location of choice for carious lesions

63 responses

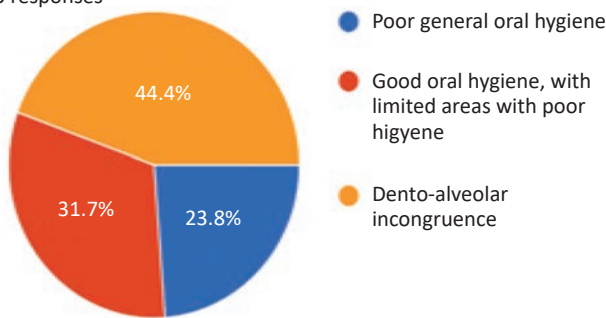


FIGURE 4. Etiology of dental caries on adjacent teeth on adjacent teeth

poor general oral hygiene, 31.7% (20) consider the adjacent proximal caries are a result of a generally good oral hygiene but with limited areas (1-2 teeth) incorrectly cleaned for different reasons such as lack of oral health education or muscle damage and finally, 23.8% (15) consider dento-alveolar incongruence as the main cause (Figure 4).

Based on these answers, we can state that in the case of carious lesions on adjacent teeth the main etiological factor is inadequate or totally absent oral hygiene. The continuous presence of pathogenic oral biofilms is the main etiological factor for dem-

ineralization and will lead to loss of hard dental tissues, process that is accelerated in the case of narrow, retentive spaces like proximal areas that are difficult to be correctly cleaned [3,4].

5. The following question is related to the **diagnostic methods** used for superficial and medium carious lesions and had 4 predefined answers with the possibility of choosing several options depending on personal professional experience. It is obvious that the most used diagnostic method is the clinical examination being preferred by 95.2% (60) of the doctors who responded to the questionnaire, followed by the radiological examination chosen by 87.3% (55) of the respondents, then the diagnosis based on the described symptomatology by patient 33.3% (21) and last but not least by methods of transillumination of the dental surfaces (Difoti digital imaging fiber-optic transillumination method) used by 23.8% (15) of the people surveyed (Figure 5).

Based on the answers, we can see that in the vast majority of cases, the use of at least 2 methods is preferred to be able to provide an appropriate diagnosis. Clinical examination shows an increased degree of efficiency in the case of medium or advanced

63 responses

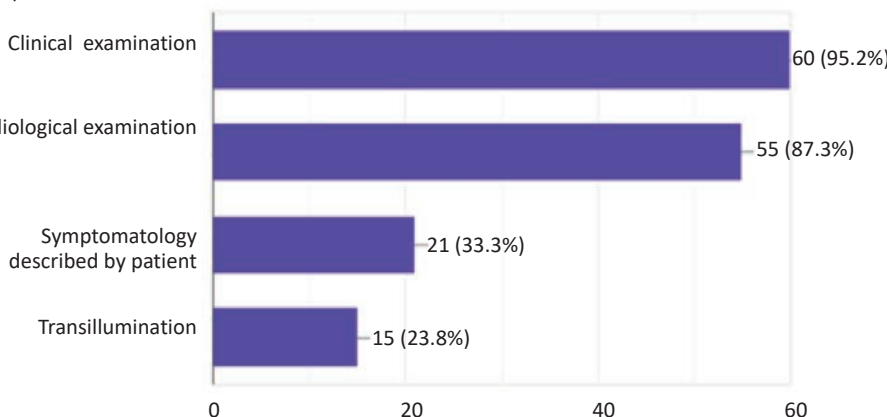


FIGURE 5. Diagnostic methods for adjacent dental teeth dental caries

caries, which are directly visible or detectable by probe detection [5]. In the case of superficial or hard-to-detect lesions, such as those located below the point of contact, it becomes mandatory to use additional diagnostic methods that can show the presence and size of carious processes, the most effective methods being the radiographic ones [6]. Transillumination methods represent an alternative, but its efficiency is clearly inferior to imaging methods. In the case of the symptomatology described by the patient, it is only a starting point in establishing the diagnosis, not a certainty and must obviously be corroborated with objective data.

6. The next question was related to the **connection between the use of additional means of oral hygiene and the appearance of dental caries lesions on adjacent teeth**. The question refers to dental floss, interdental brushes, mouthwash and was a closed type with 2 answer options. A number of 93.7% (59) of the respondents considered that there is a direct connection between the non-use of oral hygiene aids and the appearance of carious lesions on adjacent teeth, and only 6.3% (4) considered that the additional oral care aids have no influence at all (Figure 6).

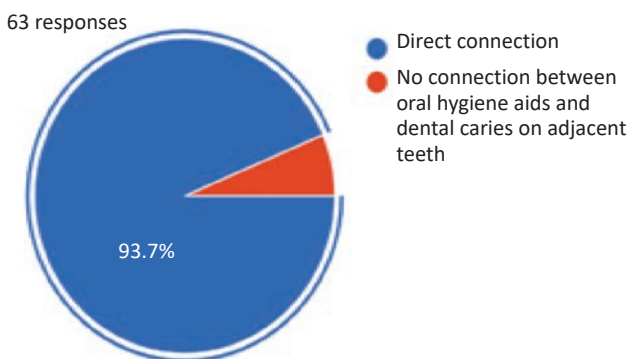


FIGURE 6. Additional means of oral care and dental caries on adjacent teeth

Tooth brushing, either manual or electric, ensures effective cleaning only of the vestibular, oral and occlusal surfaces, therefore, the use of auxiliary means of hygiene, mainly dental floss, is mandatory. Flossing has the main purpose of removing the bacterial microfilm from the proximal surfaces of the teeth, not just removing interdental food debris as most patients believe. Also, the self-cleaning processes show a much lower effectiveness in the case of approximate faces, aggravating the retention and consequently the deposition of bacterial plaque [7].

7. Question number 7 collects information regarding the **appearance of the two carious lesions on adjacent teeth**. The vast majority of respondents 76.2% (48) believed that initially the lesion appears on one tooth and this one, untreated, will lead to affect the adjacent proximal area to which it is in

close contact; 23.8% (15) consider that the adjacent dental caries appear simultaneously on both teeth (Figure 7).

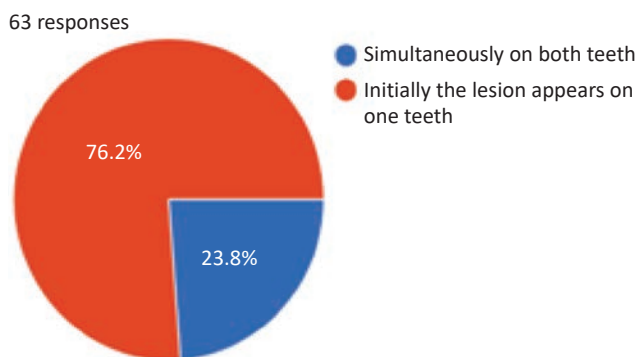


FIGURE 7. Appearance of the two carious lesions on adjacent teeth

The occurrence of this kind of lesions on adjacent teeth is mainly influenced by the condition of the two involved teeth. Even if topographically they are located in the same region, the degree of mineralization of the enamel can be different, the amount of bacterial microfilm at the level of the respective proximal face is not the same, and self-cleaning does not take place in the same way. Also, clinically, most of the time the two lesions are identified in different evolution stages, confirming that the progression of the two carious processes is a sequential process. The appearance of the first proximal enamel and dentin defect makes the respective dental surface no longer smooth, which leads to an increase in the adhesion of the bacterial microfilm [8]. An increased amount of bacterial plaque at this level will lead both to a further progression of the dental caries and also to involving the adjacent tooth proximal surface.

8. The 8th question refers to **how the dentist explains the diagnosis to the patient**: 73% (46) of the questioned dentists responded that they use the expression “face-to-face cavities” or “mirror cavities”, while 27% (17) prefer to use mainly medical terms (Figure 8).

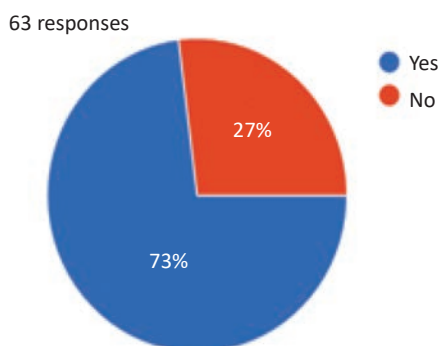


FIGURE 8. Using „mirror dental caries” term for adjacent teeth

The use of a language with easy-to-understand terms is a good method of dentist-patient communication, as he will understand the diagnosis and the treatment options much more easily, giving his consent for the treatment in full knowledge of the cause. Conversely, the use of only familiar, easy-to-understand terms can create the impression of a lack of medical knowledge, thus reducing the patient's trust in the attending dentist, therefore it is good that the use of this type of language comes strictly as a complement to the explanations provided with the help of medical terms.

9. The next question refers to the **stage in which carious lesions on adjacent teeth are most often detected**. Respondents had the opportunity to choose one or more answer options and the 105 answers from 63 respondents were divided as follows: 57 answers for medium lesions (90.5% of people ticked this answer), followed by deep caries with 31 answers (49.2% of people ticked this answer) and last but not least, superficial lesions with 17 answers (27% of people ticked this answer) (Figure 9).

Analyzing each answer separately, we can see that most answers were for combinations between the medium and another depth (shallow/deep cavity). These answers support the idea of the successive appearance of the two dental caries, highlighted by the lesions different spatial evolution. These data reveal the fact that in the vast majority of cases, the lesions are discovered at the earliest when they reach a medium depth stage, which often means that it has become visible or painful, and treatment is mandatory. Shallow lesions are discovered during regular check-ups or if the patient presents to the dental office for another problem, not being painful or visible in the case of mesial or distal surfaces. [9]. Also, sometimes a shallow proximal dental caries is discovered while a medium/deep one is treated on the adjacent tooth.

63 responses

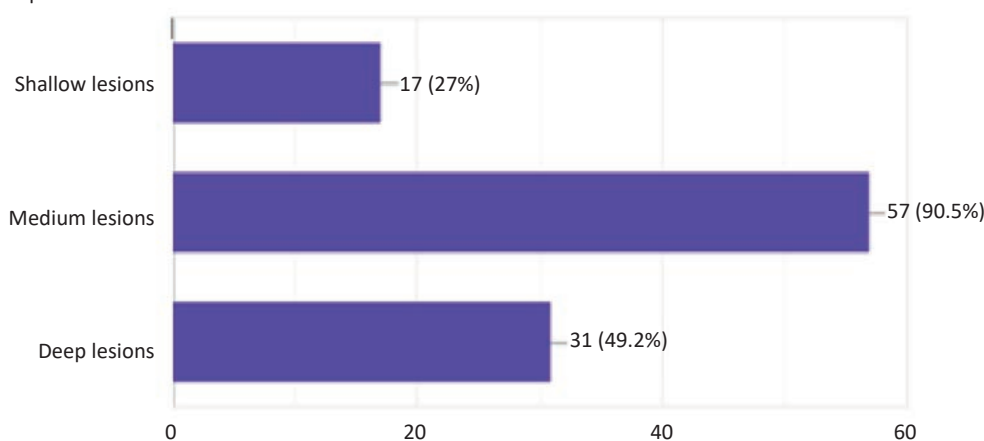


FIGURE 9. Stage in which dental caries on adjacent teeth are detected

10. Number 10 question number in the questionnaire refers to **the therapeutic approach of the two dental caries on adjacent teeth**. 85.7% (54) of the dentists who completed the questionnaire stated that they prefer to treat both affected teeth simultaneously, while 14.3% (9) of them believe that the two lesions should be treated one by one, in different treatment sessions (Figure 10).

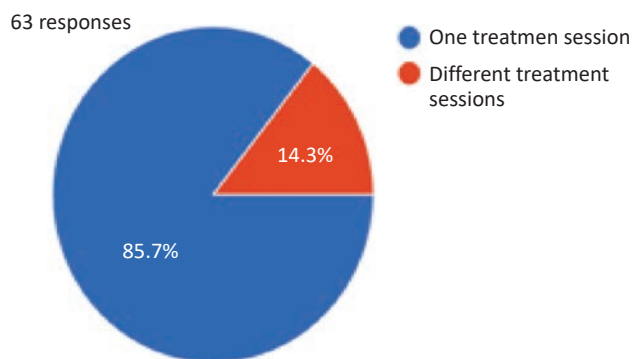


FIGURE 10. Therapeutic approach of dental caries on adjacent teeth

Treating both lesions simultaneously presents a series of advantages for both the attending physician and the patient, such as: increased visibility of the dental caries through the cavity created on the adjacent tooth, extended working space, easier insertion of the coronal conformation systems, one dose of anesthesia for both teeth, a single visit to the dental office. The actual restoration is done successively for the two prepared cavities. This question is only relevant if the patient agrees to treat both teeth in the same treatment session, as it involves a longer working time, which can be a challenge for people with general health problems (diabetes, temporomandibular joint problems) or during pregnancy.

11. The next question of the questionnaire refers to the **treatment operative technique** for the dental caries. In this case, the majority of responses, i.e.

76.2% (48), were for conservative techniques, 15.9% (10) for minimally invasive techniques (fissurotomy, tunnel cavity) and 7.9% (5 respondents) for the conventional cavities preparation described by Black (Figure 11).

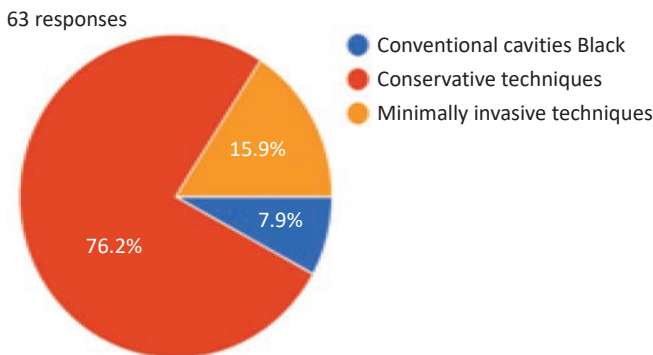


FIGURE 11. Treatment operative for cavities preparation

Currently, all techniques used for direct restorations are based on the principle of dental tissue economy, supported by the use of dental materials with chemical adhesion to the substrate. The cavity prepared for these materials will result strictly from the removal of affected tissues, preventive extension and retentive preparation being currently considered an unnecessary sacrifice of dental hard substance [10]. As for minimally invasive techniques, they can only be applied in certain situations and often require specific instrumentation. For example, in the case of tunnel-type cavities, it is mandatory that the marginal enamel ridge is unaffected, the entire preparation being made below it in order to preserve its integrity. However, due to reduced visibility and working space, it is possible that areas of necrotic dentin to remain with subsequent recurrent dental caries. Because of these disadvantages, the rate of use of minimally invasive techniques is quite low, being used more often only in the case of class I cavities through fissurotomy [11].

63 responses

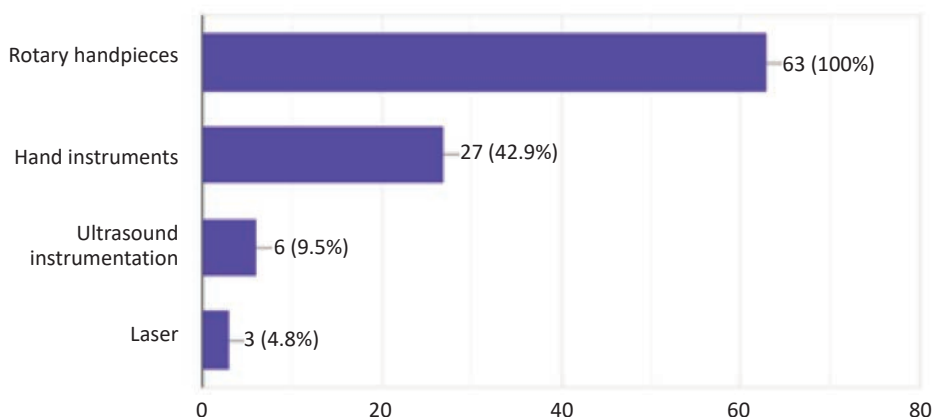


FIGURE 12. Operative instruments used for cavities preparation

12. Question number 12 in the questionnaire refers to the **operative instruments** used for preparing the cavities and offered the opportunity to choose several answers to see how different types of instruments are combined. As expected, rotary handpieces were chosen by all 63 respondents (100%), followed by conventional hand instruments (excavator, Black spoon) with 27 responses (42.9% of people ticked this answer), ultrasound-based instrumentation (sonic and ultrasonic abrasion) with 6 answers (9.5% of people checked this answer) and last but not least, the laser (Er-yag laser) with 3 answers (4.8% of people choose this answer) (Figure 12).

From the collected data it can be seen that rotary instruments are still the main type of abrasive tools used by all dentists, given by the high efficiency and huge variety of burs that make their use possible in all clinical situations. The other types of instruments have an auxiliary action compared to the rotary one. For example, instruments with ultrasonic vibrations present a much lower efficiency compared to rotary instruments, therefore their use in restorative dentistry is limited only to finishing and beveling the cavity walls or finishing and polishing the final restoration. Hand instruments are currently used only in very deep cavity areas, near the pulp chamber or in anxious patients/with mental problems, who, frightened by the noises produced by the rotating instruments, risk moving, leading to intra-operative accidents.

Laser instrumentation is the newest minimally invasive cavity preparation technique. It presents multiple advantages, such as minimal sacrifice of hard tissues, precision, dentine sterilization, minimized patient fear for the drill, blocks dentinal tubules thus prevents dentin hypersensitivity [12]. Unfortunately, the main disadvantage is related to the very high acquisition price, which is also observed in the questionnaire by the small number of dentist who use laser technology.

13. The next question of the questionnaire refers to Class II **cavities design** and the need for an occlusal retention cavity for composite materials. Of the 63 respondents, 55.6% (35) stated that in the case of composite materials the retention cavity is no longer necessary, while 44.4% (28) still consider it necessary for the success of the restoration (Figure 13).

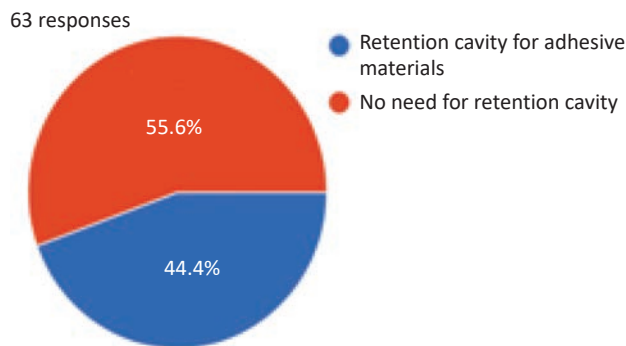


FIGURE 13. Design cavities and the need for occlusal retention cavity for resin composites

Because composites rely primarily on chemical retention provided by adhesive systems rather than mechanical retention, the horizontal retention cavity in Class II cavities is no longer required. On the contrary, it is even considered unnecessary sacrifice of dental hard tissues by conservative techniques. Conversely, in the case of cavities with very small dimensions, an occlusal cavity can be created in order to increase the adhesion surface of the composite material, not to create mechanical retention, and its dimensions will be reduced [13].

14. Question number 14 is also related to design cavities and it refers to a situation often encountered in the case of carious lesions on adjacent teeth, namely when one of the teeth presents a **medium/deep carious lesion and on the adjacent tooth surface only a shallow proximal lesion with intact marginal enamel ridge**.

In this situation, the majority of responding physicians, 85.7% (54), prefer to create a class II cavity for the deeper lesion and a box type cavity for the superficial one. Conversely, 14.3% (9) consider it necessary to prepare two Class II cavities regardless of the depth of the lesions (Figure 14).

The concept of preparing a box shape cavity starts from the idea of tissue-saving caries management approach. If in a situation where the adjacent tooth is intact we are forced to a conventional Class II cavity, in the case of dental caries on both adjacent teeth we can obtain visibility and direct access to the shallow lesion through the cavity created on the more affected adjacent tooth. The benefit obtained is the preservation of the integrity of the marginal enamel ridge, which provides the tooth with resistance to occlusal forces [14]. A disadvan-

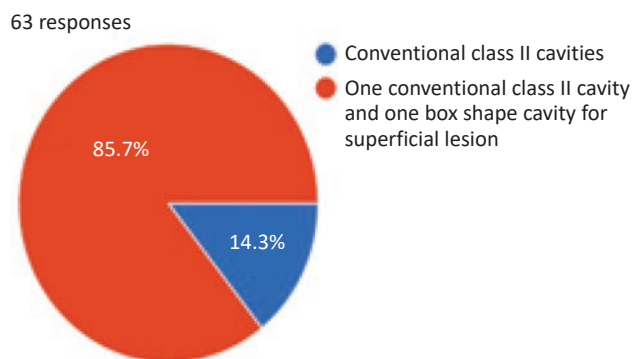


FIGURE 14. Cavity preparation for a shallow proximal lesion with intact marginal enamel ridge facing medium/deep carious lesion and on adjacent tooth

tage of this method is related to the incomplete removal of the affected tissues due to the more difficult access, which can cause the subsequent recurrence of caries. Also, the therapeutic approach in the form of a box is difficult on the distal faces of the lateral teeth.

15. Question number 15 referred to the **isolation of the operative field method** used, so that of the answers received, 63.5% (40) of respondents prefer the rubber dam method and 36.5% (23) the absorbent method (Figure 15).

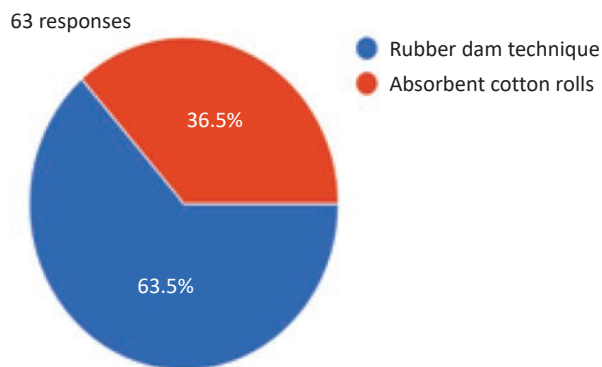


FIGURE 15. Isolation methods used in dental caries treatment on adjacent teeth

The absorbent cotton rolls and saliva ejector, although a simpler technique to use, is less effective in achieving adequate isolation, so it has been replaced by the rubber dam method. This system implies some additional time consumption and patient objection from the slight discomfort experienced, but it manages to achieve an almost perfect isolation of the operative field. This is extremely important for adhesive techniques, especially for composite resins, thus obtaining a restoration with increased longevity in the oral cavity [15]. Also, it prevents saliva which contains microorganisms to penetrate and persist during restorative stage, preventing recurrence of dental caries.

CONCLUSIONS

This cross-sectional study conducted among dentists in Romania indicated that dental caries on adjacent teeth are easily recognized and practitioners are well informed about etiology and modern diagnostic methods.

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At the same time, the therapeutic approach is carried out in the great majority of clinical situations based on the principles of modern dentistry, using adhesive materials that allow the economy of hard dental substance.

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