

Dental Biomaterials in Dental Filling: Why and How to Use?

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ORIGINAL RESEARCH ARTICLE

Abstract

There are a multitude of dental biomaterials used for coronary filling: composites, glass ionomer cements, amalgams, compomers, and others. A cross-sectional study was conducted using an anonymous questionnaire with 130 dentists, with options on the types of biomaterials used in the direct reconstruction of the dental crown. The study show that composite materials are the most used in the coronary reconstruction of permanent teeth, and glass ionomer cement for temporary teeth. A better understanding of the components, advantages and disadvantages of each category of biomaterials offers the possibility to select the right material for the right clinical situation.

Keywords: dental biomaterials, coronary filling, permanent teeth, temporary teeth

I. INTRODUCTION

There are a multitude of materials used for coronary filling: composites, glass ionomer cements, compomers, amalgams and others. Specialists say that there is no type of biomaterial used for direct coronary reconstruction that is the best, it is chosen depending on the particularities of the clinical case, the operator's preferences, possible allergies of the patient, and more.

The aim of this study was to investigate the opinions and current use of biomaterials used in dental treatments for both temporary and permanent teeth; investigating the opinion related to the use of dental cavity liners materials before placing composite restorations by dentists; assessing how the level of

clinical experience (years of graduation) or postgraduate training influenced their options.

II. MATERIAL AND METHODS

A cross-sectional study was conducted using an anonymous questionnaire (Figure 1) with dentists. Information was gathered on post-graduate training (specialization, master's or doctorate) and linear experience (years after graduation). 130 responses were collected with options on the types of biomaterials used in the direct reconstruction of the dental crown, on temporary and permanent teeth, as well as options on composite restorations (composite type, use / need for indirect styling materials). The data were subjected to descriptive analysis.

III. RESULTS AND DISCUSSION

A. Results

In terms of linear experience (years after graduating from the Faculty of Dentistry) the distribution of respondents is relatively balanced: 41% are young graduates and doctors with up to 10 years of experience, 27% have experience between 10 and 20 years, and 32% are over 20 years old after graduating from college (Figure 2). Most study participants work in offices located in urban areas (89.9%) (Figure 3).

Regarding professional training, we have three categories of doctors: dentists with a bachelor's degree, specialists or primary doctors in dentistry (Figure 4). Some of them graduated, as postgraduate training, master's or doctoral studies, or both (Figure 5). Thus, 94 are dentists with a

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bachelor's degree (one has a master's and doctorate in dentistry, 6 have doctoral studies, respectively 3 have master's studies). 26 of the respondents are dentists (2 have doctorates), respectively 10 are primary dentists (one has a master's and doctorate in dentistry, 5 have a doctorate and one a master's degree).

QUESTIONNAIRE: Use of materials for direct dental restoration

1. How long ago have you graduated from the Faculty of Dentistry?
 - less than 10 years
 - between 10 and 20 years
 - more than 20 years
2. What is your training? (can be multiple answer)
 - Dentist
 - Dentist
 - Primary dentist
 - Master in dentistry
 - Doctorate in dentistry
3. Where is the office where you work located?
 - Urban environment
 - Country environment
 - University center
4. What filling material do you use most often on temporary teeth?
 - composite
 - compomer
 - glass ionomer cement
 - zincophosphate cement
 - cement zinc oxide eugenol
 - silver amalgam
5. What type of composites do you use most often at the level of permanent teeth?
 - Microhybrid
 - Nanohybrid
6. For deep cavities do you use dental cavity liners under composite restorations?
 - Yes
 - No
7. If so, by whom? (can be multiple answer)
 - compomer
 - glass ionomer cement
 - zincophosphate cement
 - cement zinc oxide eugenol
 - calcium hydroxide
8. For medium cavities do you use dental cavity liners under composite restorations?
 - Yes
 - No
9. If so, by whom? (can be multiple answer)
 - compomer
 - glass ionomer cement
 - zincophosphate cement
 - cement zinc oxide eugenol
 - calcium hydroxide
10. Which of the following materials do you use to fill permanent teeth? (can be multiple answer)
 - Ormocer
 - Ceromer
 - Resin-modified glass ionomer cement
 - Amalgam-reinforced glass ionomer cement
 - Silver amalgam
11. Do you consider it necessary to place a base material under the composite fillings in the deep cavities?
 - Yes
 - No
 - I don't know
12. Do you consider it necessary to place a base material under the composite fillings in the medium depth cavities?
 - Yes
 - No
 - I don't know

Figure 1. Questionnaire: use of materials for direct dental restoration

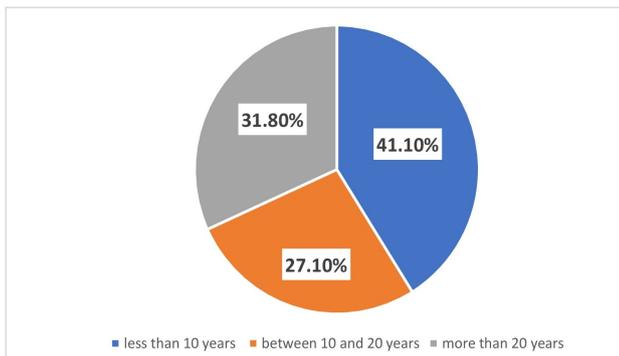


Figure 2. Distribution of study participants by the period after graduation

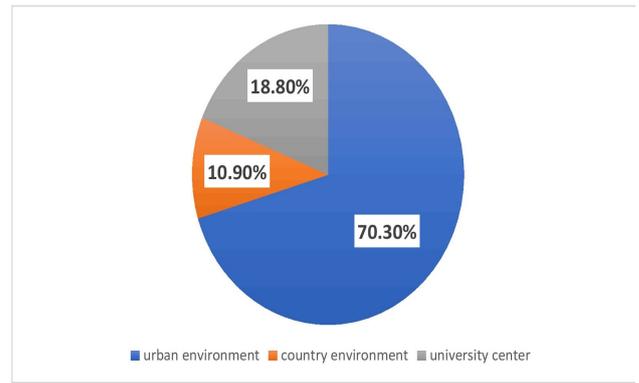


Figure 3. Distribution of study participants by the environment in which they practice

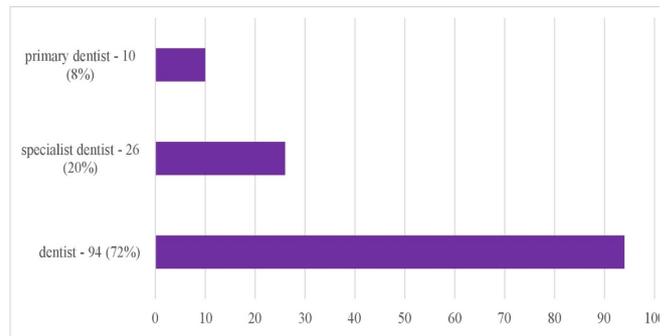


Figure 4. Professional training of doctors participating in the study

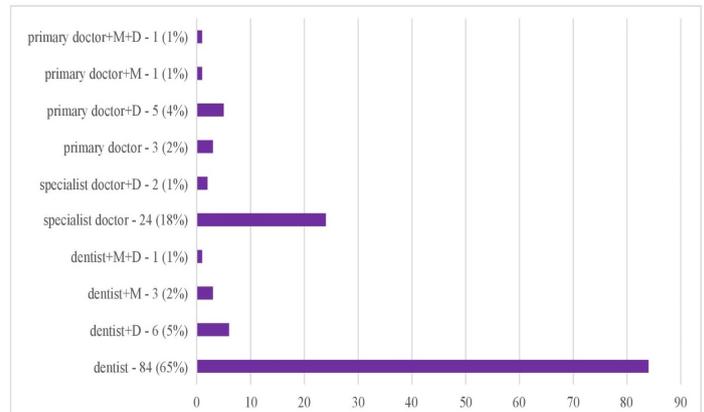


Figure 5. Professional and postgraduate training of physicians participating in the study (M = master's degree in dentistry, D = doctorate in dentistry)

Regarding the use of filling biomaterials for temporary teeth, the preferences of the doctors participating in the study are, in descending order: glass ionomer cement, composites, zincoxydeugenol cement and zinc phosphate cement (Figure 6). Dentists who participated in the study do not use compomer

class materials or silver amalgams for the restoration of temporary teeth.

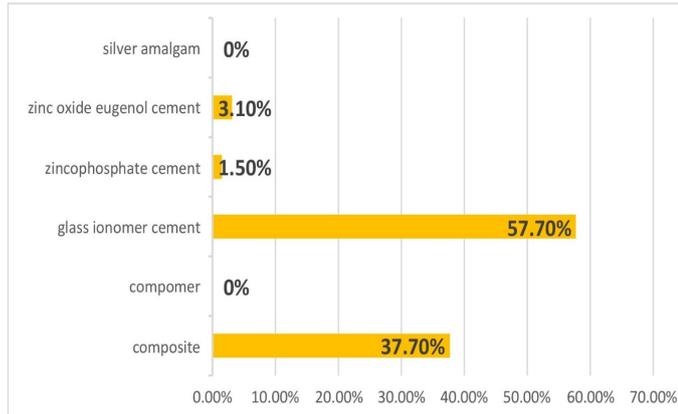


Figure 6. Use of filling biomaterials for primary dentition

Because study show that composite materials are the most used in the coronary reconstruction of permanent teeth, I was interested in the option of dentists participating in the study on restorations with this type of biomaterial. Thus, between the use of nanohybrid and microhybrid composites, the options were slightly in favor of the former (Figure 7).

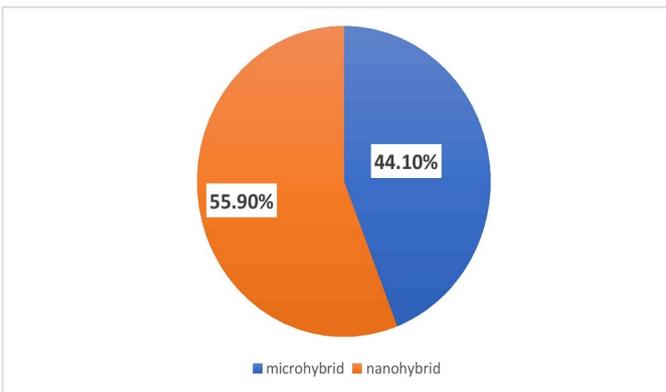


Figure 7. Ratio in the use of nanohybrid and microhybrid composites

Interesting was the study on the options of placing or not the dental cavity liners under the composite materials, for deep cavities and those of medium depth (Figures 8,9).

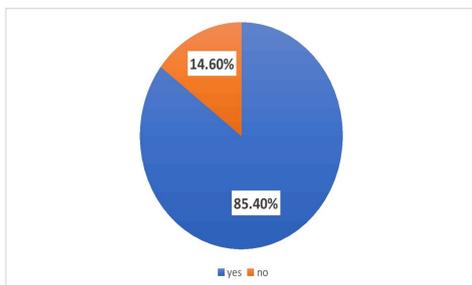


Figure 8. Options for placing dental cavity liners under composites materials for deep cavities

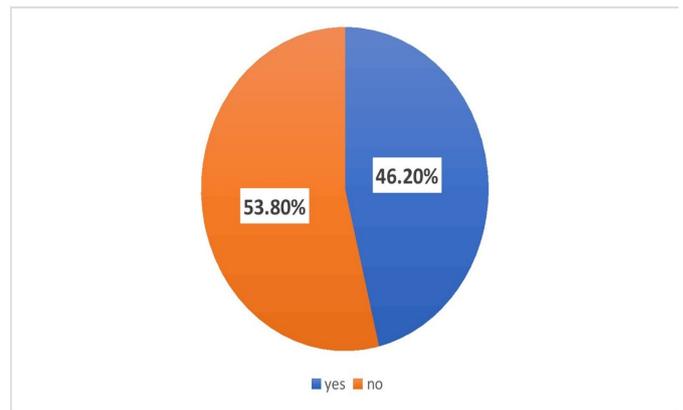


Figure 9. Options for placing dental cavity liners under composites, for medium depth cavities

Regarding the deep cavities, out of the 19 doctors who are not for dental cavity liners, 8 are under 10 years old after graduation, 7 between 10 and 20 years old, and only 4 over 20 years of professional experience, 3 of them having a specialty / primary or doctorate in dentistry.

Regarding the option of liners for the medium depth cavities, the pros and cons are almost equally divided (60 and 70 respondents, respectively).

As preferred materials of liners in deep cavities we have, in descending order: calcium hydroxide and glass ionomer cement, followed at a distance by compomers, zinc phosphate cement and zinc oxide eugenol cement (Figure 10).

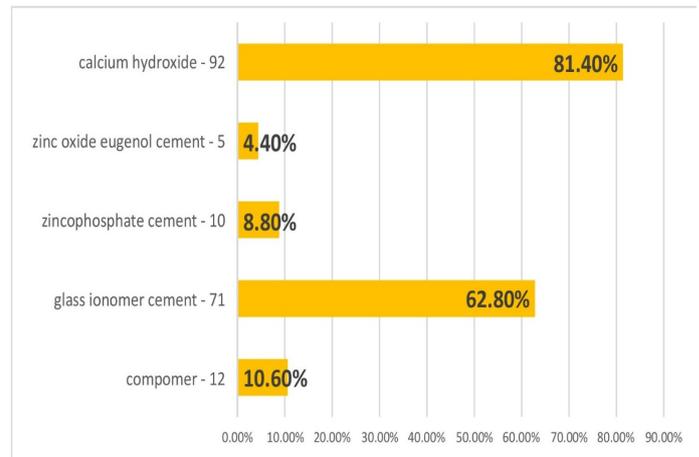


Figure 10. Preference of physicians participating in the study for the materials used as dental cavity liners in deep cavities

As preferred materials of liners in medium depth cavities we have, in descending order: glass ionomer cements, calcium hydroxide, compomers and zinc phosphate cement (Figure 11).

Also, the participants in the study were interviewed on the need to place dental cavity liners under composite fillings in deep cavities, respectively those of medium depth. The results are illustrated in figures 12 and 13.

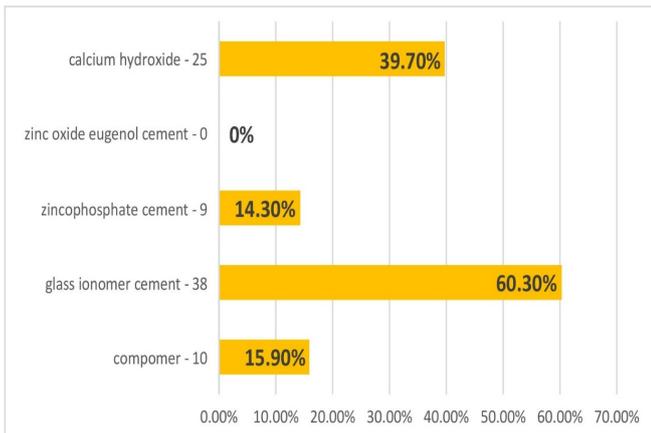


Figure 11. Preference of physicians participating in the study for the materials used as dental cavity liners in medium depth

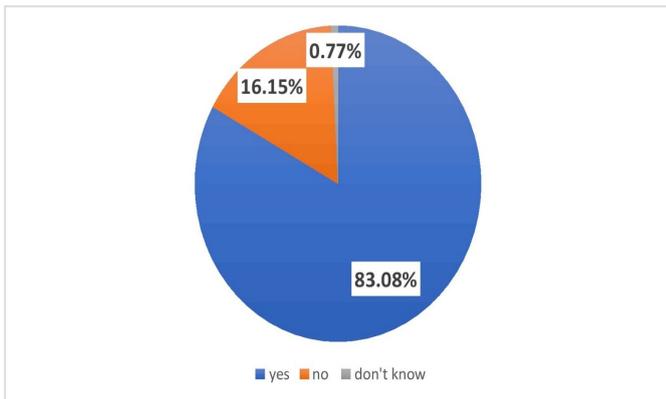


Figure 12. Opinion of the physicians participating in the study regarding the need to place dental cavity liners under composite fillings in deep cavities

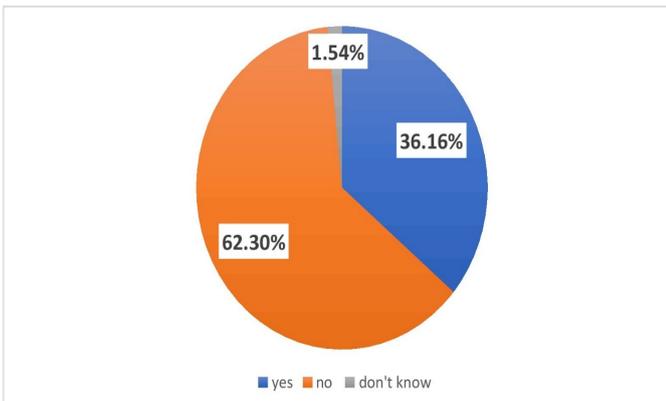


Figure 13. Opinion of the physicians participating in the study regarding the need to place dental cavity liners under composite fillings in medium depth cavities

In addition to composite materials, other biomaterials are used in making fillings for permanent teeth: ceromers, ormocers, resin-modified glass ionomer cements, glass ionomer

cements reinforced with silver amalgam, silver amalgams, compomers, etc. The preferences of dentists participating in our study are overwhelmingly proportional to resin-modified glass ionomer cements (Figure 14).

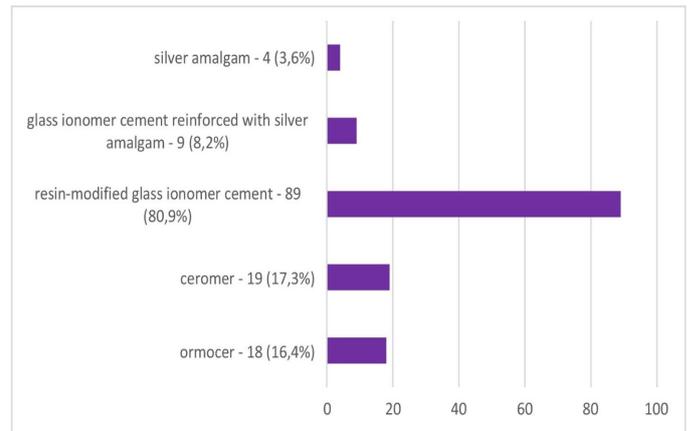


Figure 14. Preferences of dentists participating in the study for other types of biomaterials used as dental fillings

Of the total of 130 participants in the study, 20 (15.38%) do not use any of the materials listed in question 10 for filling permanent teeth, as an alternative to composite fillings.

B. Discussion

The classic approach to the treatment of deep carious lesions involves the complete elimination of infected dentin. In these cases, treatment may require measures such as indirect coverage of the pulp (by using a protective material). Choosing this option, to avoid possible complications, can be controversial for the dentist. To minimize the potential complications of complete removal of carious dentin from the vicinity of the dental pulp, several authors have investigated and proposed alternative approaches, such as stepwise or two-stage excavation of carious tissue. Controversial is the method of conservative or ultraconservative removal of decayed tissue, often referred to as "partial removal of decayed lesions" [1-11].

There are studies on the teaching in dental schools of composite resin materials, especially for posterior teeth. Most faculties no longer teach amalgam as a preferred posterior restoration material [12-17]. However, there are studies that suggest that composite resins lead to higher failure rates and the risk of secondary caries compared to amalgam restorations. These studies reinforce the benefits of amalgam restorations, and the results are especially useful in countries where amalgam is still the material of choice for posterior tooth restoration [18,19].

There are also numerous studies on the use of dental cavity liners, by placing an insulating layer between the restorative material and the remaining dental structure. They have been used in order to protect the dental pulp from the toxic effects of some dental restorative materials and to prevent pain

due to the thermal conductivity of the restorative material [20,21].

And for temporary dentition there are numerous studies on the types of materials and techniques used. Silver amalgam has become a less used dental restorative material in pedodontics. After a period of scientific and non-scientific controversy, the use of silver amalgam for primary dentition is declining, not because of its mercury content, but because pediatric dentistry has come up with more suitable materials: silver-reinforced glass ionomer cements, cements resin-modified glass ionomers and polyacid-modified composite resins (compomers) [22 - 28].

IV. CONCLUSION

This survey showed that glass ionomer cements, followed by composite materials were the first choices of dentists for direct dental restorations in the primary dentition. For filling permanent teeth, nanohybrid composites are preferred to microhybrid ones.

Decisions for dental cavity liners under composite restorations in moderately deep and deep cavities are controversial among dentists, resulting in the need to generate more convincing data, through practice-relevant studies, on the use of these materials and informing dental professionals.

Although several types of biomaterials for tooth restoration can make it more difficult to choose the right material, a better understanding of the components, advantages and disadvantages of each category of biomaterials offers the possibility to select the right material for the right clinical situation.

Conflict of interest. The authors declare that they have no conflict of interests.

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