

# The Use of Diacrylic Resins in Dental Restorations

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*The materials as well as the procedures used successfully in modern dental restorations are based on scientific selection criteria, which can predict outstanding results, both in terms of physiological aspects and the durability of the performed maneuvers. The rationale of using certain materials, as the success or failure in using certain techniques, has contributed to the evolution of dental restorations. The optimal way to combine the material with its applicability and finishing technique implies an exhaustive approach to the subject that still requires research, that address to specialists, in order to improve its refinement and development. Among the restoration materials, those that satisfy the aesthetic requirements of the patients are considered to be composite resins. With all the advantages resulted from their intrinsic characteristics, it should be noted that composite resins still have inconveniences, primarily linked to the polymerization shrinkage, which causes a gap between the obturation and the dental tissue, resulting in the formation of marginal microinfiltrations with all the drawbacks associated with it. The purpose of the experimental research is to evaluate the marginal microinfiltrations at the level of the class II cavities restoration with composite diacrylic resins, according to various techniques of restoration and to establish the optimal technique to minimize side effects.*

**Keywords:** diacrylic resins, techniques of restoration, obturation.

The last step in the treatment of simple caries is the restoration of coronary morphology with a microprosthesis technically named obturation [1-3]. Stopping the development of the caries process is performed by excision of all altered tissue, resulting in a solution of continuity in the dental tissues. Dental composites and their adhesive systems allow maximal preservation of dental rigid structures by providing both resistance, and minimal pulp inflammation during restoration.

Before this is done, the patient will be questioned about his medical history: the presence of general chronic diseases such as diabetes mellitus, former surgical interventions, drug allergies. These co-morbidities can influence clotting factors and tissue scarring rates [4-7].

For the proper rendering of the anatomical shape of the teeth in the prosthesis process, it is necessary to know the anatomic particularities of each tooth, particularly for the dental crown. As anatomical features, incisors and canines have 1 root and 1 channel; the upper first premolar has 2 roots and 2 channels; second superior premolar and lower premolars have 1 root and 1 channel; upper molars have 3 roots and 3 channels; lower molars have 2 roots and 3 channels. Wisdom tooth have an inconsistent root morphology. Of the multitude of anatomical variations in each tooth, the ones listed above are the most common.

Teeth are distinguished by several criteria, whose knowledge is of particular importance in prosthetics, in modeling anatomic shape and in making the physiological aspect of prostheses. The most important criteria would be: a root criterion, determined by the direction of the root axis deviation that indicates the origin in dental hemiarcade, the angles of the crowns of anterior teeth, the curvature of the

vestibular surface, the crown edge, the number of cusps, the size and position on the occlusal surface at the lateral teeth.

Diacrylic resins are materials with a good quality/price ratio and a remarkable physiognomic aesthetics [8]. Face aging phenomena affect the nasal cavity, the lacrimal apparatus and the oral cavity. Thus, a very important role in prosthetics is the maintenance of the aesthetic aspect and the local impact it produces - the modification of the oral cavity anatomy, the influence of the salivary secretion, the challenge of the neuralgia [9-13].

The diacrylic composite resins (DCR) used by practitioners in many clinical situations in dental restorations lead to successful results, but only through learning proper techniques and respecting the technology of restoration [14-17].

Of utmost importance are the quality of the polymerization process and the shrinkage of the outlet, two issues that are currently unresolved in the treatment of odontal lesions with DCR [18-23]. The objective of the research is to evaluate the marginal microinfiltrations in composite resin restorations, depending on different restorative techniques at the level of the class II cavities. It will be highlighted the optimal method of restoration and the techniques that can be learned and applied by practitioners in order to optimize the clinical behavior of the photopolymerizable diacrylic composite resins, used in direct restorations.

## Experimental part

### Materials and methods

In order to achieve experimental research, it has been used a number of specific dental materials and

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investigations were conducted with specialized equipment.

**Materials:** maxillary and mandibular molars and premolars; diestonegypsum; diamond drill (spherical, cylindrical, inverted cone) for finishing; diamond disk; applicators; interdental wedges; metal matrices; portmatrice; 36% phosphoric acid; Adhesive; fluid composite (3M ESPE); composite; methylene blue.

**Equipment for the investigation of restorations:** optical endodontic microscope (Zumax / figurel) and digital camera (Nikon D3100).

The study was conducted on 30 maxillary and mandibular molars and premolars, collected over a period of 3 months from dentists with private practice.

After extraction, the teeth were sanitized and kept in physiological saline. They were then inserted into gypsum blocks with the root portion, and the contact point between them was made in order to highlight their situation in the oral cavity. On those 30 maxillary and mandibular molars and premolars, were prepared class II cavities by using spherical, cylindrical and inverted cone diamond drills. The teeth were divided into 3 groups:

I. 10 teeth obturated using technique with *pre-photopolimerised composite inserted*;

II. 10 teeth obturated using *flow technique with liquid composite*;

III. 10 teeth obturated using *stratification technique* or oblique incremental technique (OIT), using *viscous composite*.

There after, the teeth were restored using different techniques on the three groups of teeth.

Regardless of the filling technique, for all three groups of teeth, the following procedure was performed: the 36% orthohosphoric acid was used as etching solution for dental cavity for 20 s; the cavity was washed for 15 s; the cavity was dried by air jet from the dental unit; the adhesive was applied and photopolymerized for 20 s.

For the first group of teeth, a first layer of composite fluid was applied to the gingival wall, a pre-photopolymerized insert was introduced, and then the cavity was closed, using through the stratification technique (fig. 1). For group II, a layer of 1 mm of fluid composite was applied directly to the gingival wall of the cavity, and then the cavity was obturated through the stratification technique (fig. 1). For group III, the first composite layer was applied directly to the gingival wall, in oblique position and photopolymerized for 40 s; the other layers were introduced by the same technique, the oblique incremental technique (OIT). After filling the cavities, the teeth were introduced into 1% methylene blue for 24 h, after which they were cut using a diamond disk mounted to a straight piece in the vestibule-oral direction in 1 mm sections (fig. 2).

The sections were analyzed at the Zumax endodontic optical microscope, at 50X magnification. The images were taken with the Nikon D 3100 digital camera attached to the endodontic optical microscope (figs. 3- 5).

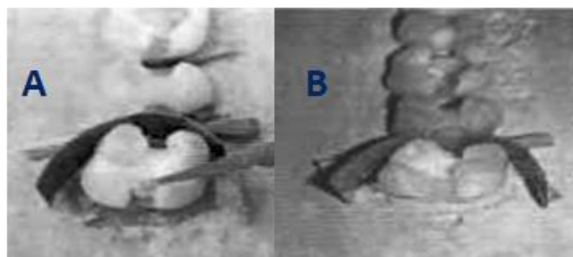


Fig. 1A=Application of the adhesive; B=Applying the fluid composite and the metal matrix (group I)

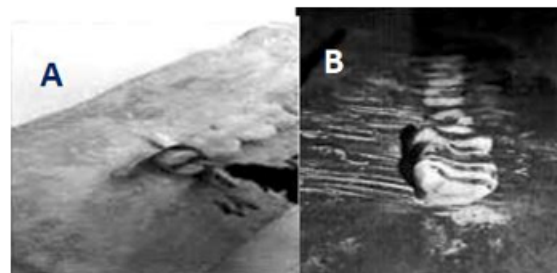


Fig. 2A=Applying the fluid composite; B=Vestibulo-oral sections (Group II)

The extent of infiltration was analyzed at the level of each section (mesial, central, distal) in the gingival, vestibular and

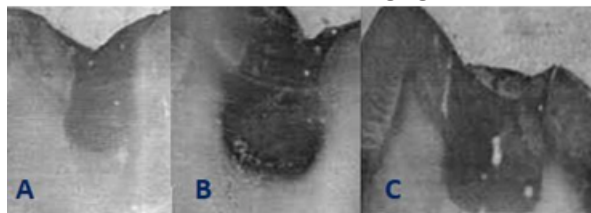


Fig. 3A=Medial section; B=Central section; C=Distal section (group I)

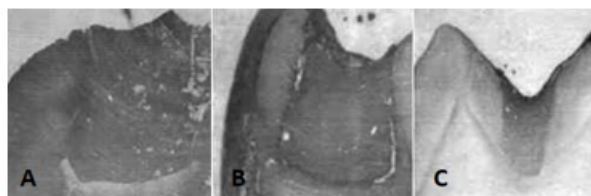


Fig. 4A=Medial section; B=Central section; C=Distal section in second group

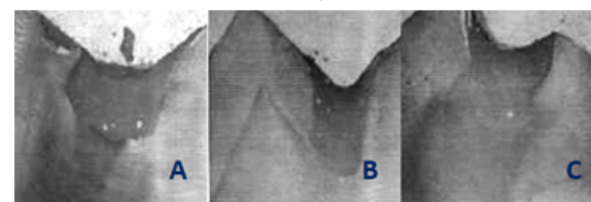


Fig. 5A=Medial section; B=Central section; C=Distal section

oral walls, and the data obtained were processed by using Microsoft Excel program.

## Results and discussions

After the research was done, the quality of restorations was evaluated.

It were compared the infiltrates from vestibular (V), oral (O) and gingival (G) walls, by analyzing those three sections (medial, central, distal) of the obturated teeth by those three restoration techniques. We then conducted a comparative study about the quality of restorations through the three experimental techniques used, by comparing the degree of infiltration of the oral, vestibular and gingival walls.

As seen in the *technique with pre-photopolymerized inserts*, the highest level of infiltration (83.33%) occurs in the vestibular wall, followed by the oral wall (66.67%) and then the gingival (56, 67%) one.

In the *flow technique*, the highest degree of infiltration occurs in the oral wall (86.67%), followed by the vestibular wall (70%) and then the gingival (30%) wall.

In the IOT technique, the maximum infiltration rate is recorded in the vestibular wall (66.67%), followed by the oral wall (63.33%), the lowest infiltration rate is estimated in the gingival wall (50%).

We observe that for the *vestibular wall* the highest degree of infiltration is encountered in the technique with pre-



photopolymerized insert (83.33%), followed by flow technique (70%) and IOT technique (67%).

For the *gingival wall*, the highest infiltration rate is also recorded for the pre-photopolymerized technique (56.67%), followed by the IOT technique (50%) and the flow technique (30%).

For the *oral wall* it can be observed that the highest degree of infiltration is recorded with the flow technique (87.67%), followed by the technique with inserts (66.67%) and the last place is the IOT technique (63.33%).

Recent studies shows that a thin layer of fluid composite (0.5-1mm) has a superior marginal quality; the use of fluid composite liners can reduce the value of microinfiltrations in composite restorations, which is explained by the high percentage of the organic matrix of the fluid composite which increases the stress of shrinkage [19, 20].

A particular situation is that of minor patients, where prosthesis is recommended to be done after the written consent of the parents and after a prior clinical examination to exclude congenital malformations of the oral cavity [24-31].

## Conclusions

Marginal microinfiltrations are presented in a lower or higher percentage in all 3 used techniques. Since the composite diacrylic resins undergo dimensional variations during the polymerization process, it is very important to use the proper technique in order to obtain a good adaptation of the material to the cavity and a corresponding marginal seal. The fluid composite applied to the gingival wall cause a better marginal closure (superior sealing and low infiltration) compared to other techniques, plus the advantage of partially absorbing the mechanical shocks resulting from the chewing process. The results of the study demonstrate that the stratification technique still remains a viable technique, the oblique layers having the advantage of low thickness and reduced contraction volume.

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