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INDIRECT RESTORATION TECHNIQUE IN COMPOSITE RESIN USING SEMIRIGID MODEL

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Abstract: In the case of posterior teeth with extensive destruction of their crowns, the indirect technique is the one of choice, where it is possible to present a restoration with more detailed anatomy, precision at the point of contact, marginal adaptation and compensating for polymerization contraction at the time of cementation. The present study aims to report and illustrate the technique for creating an indirect restoration in an acrylic posterior tooth made with composite resin, made using a semi-rigid model carried out in the laboratory. Only one acrylic tooth underwent onlay preparation. A double disposable tray and quick-setting alginate were used to mold the preparation, and light addition silicone was used to create the working model. A die was made and then the composite resin restoration. The present work concluded that it was possible to report and clarify the technique for creating an indirect restoration that meets the clinical needs of restoring shape, function and anatomy of extensively decayed and destroyed posterior teeth.
Keywords: Composite resin, Permanent dental restoration, Onlay Dental aesthetics.

INTRODUCTION

With the development of composite resins and adhesive systems, the possibility of applying more aesthetic and conservative Dentistry was realized (Baratieri et al., 2011; Teles, 2020). In the case of posterior teeth with extensive destruction of their crowns, the restorative possibilities are the creation of restorations using the direct or indirect technique (Guimarães et al., 2020).

Baratieri et al. (2011) mentions that the correct choice of technique for creating composite resin restorations is closely linked to the success of the procedure. In the case of posterior teeth with large coronal destruction, the direct technique is not the most indicated due to polymerization contraction factors, marginal adaptation and difficulty in establishing an adequate proximal contact point (Teles, 2020).

The indirect technique is the one of choice in cases where there is little coronal remnant, where it is possible to present a restoration with more anatomy detail, precision at the point of contact, marginal adaptation and compensate for polymerization contraction at the time of cementation. Another advantage of the indirect technique is the greater conversion of monomers into polymers due to additional polymerization (Baratieri et al., 2001; Goyatá at al., 2018; Guimarães et al., 2020).

In the indirect technique, after carrying out the cavity preparation, it is necessary to obtain a working model. The working model can be obtained through molding, with molding materials and plaster, or through digital flow, through milling or 3D printing. And only then does the dentist obtain the restoration for subsequent cementation (Monteiro et al., 2017; Guimarães et al., 2020).

Another option for creating indirect restorations are semi-rigid models, which consist of using a silicone model fixed to assembly toy parts, so that the die-casting process is facilitated. This technique is easy to perform due to the fact that it does not involve a laboratory step and can be performed in the office, with materials that are easy to handle, such as composite resin (Borba et al., 2020).

This present work aims to report and illustrate the technique for creating an indirect restoration in a mannequin's posterior tooth made with composite resin, made using a semi-rigid model carried out in the office by the dentist himself.

MATERIAL AND METHOD

For this study, a dental mannequin from the MOM brand (Marília, São Paulo, Brazil) was used. On element 36, an onlay-type preparation was carried out, involving the MODL faces, with an FG2135 diamond tip (KG Sorensen, Serra, Espírito Santo, Brazil). The preparation features rounded internal angles, slightly expulsive walls, completion of the preparation in the proximal shoulder region, reduction in the height of the mesiolingual and distolingual cusps while maintaining their shape (figures 1A and 1B). These factors contribute to better adaptation of the restoration.

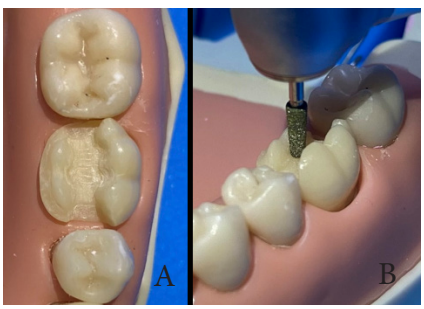

Figure 1 A: occlusal view of tooth 36 with onlay preparation. B: side view indicating the orientation of the diamond tip.

Then, according to the work of Constant et al. (2023) and Schneider et al. (2024), the following toy parts (Techbricks, Charqueadas, Rio Grande do Sul, Brazil) were used to assemble the occluder: Lego Plate 1x2 (8 units), Lego Plate 1x2 with clip (2 units), Lego Plate 1x2 with fitting for middle and sides clip (2 units), Lego Plate 1x4 (4 units), Lego Plate 2x2 (4 units), Lego Plate 2x3 (6 units), Lego Plate 2x4 (30 units), Lego Plate 2x6 (15 units), Lego Plate 2x8 (3 units), Lego Plate 2x10 (2 units), Lego Plate 4x6 (1 unit), Lego Plate 4x10 (1 unit), Lego Plate 6x12 (1 unit).

The 6x12 piece served as the base. The back part intersperses the 2x4 and 2x6 pieces to complete 13 floors, and on floor 12 two 1x2 pieces with clips were added. The pieces 4x10, 1x2 with clip fitting, 2x8, 4x6 and 3x2 were used to make the upper part. To make the incisal pin, 2x4 pieces were used (figure 2).

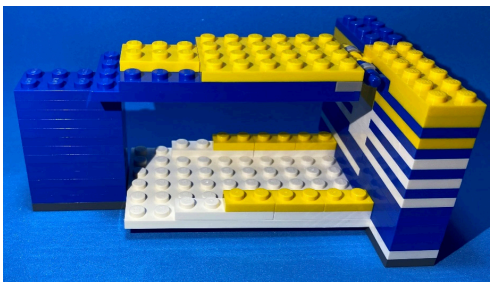

Figure 2: Toy parts occluder.

The preparation was molded using a 3D Moldex disposable double tray (Angelus, Londrina, Paraná, Brazil), which allows the upper and lower arches to be copied simultaneously; and use of quick-setting alginate Hydrogum 5 (Dentsply Sirona, North Carolina, USA) (figure 3A and 3B).

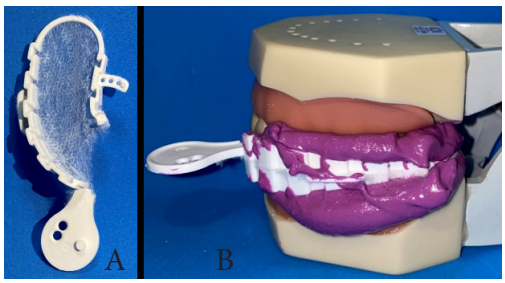

Figure 3: A: 3D Moldex disposable double tray. B: Simultaneous molding of the upper and lower arches with Hydrogum 5 alginate.

After molding (figures 4A and 4B), the working model was made with addition silicone for making Scan Die models (Yller Biomateriais, Pelotas, Rio Grande do Sul, Brazil) (figure 4C). Using an elastomer manipulation gun (DFL, Taquara, Rio de Janeiro, Brazil), the addition silicone was inserted into the lower mold and placed on the base of the occluder (figure 5A, 5B, 5C, 5D). After the time required for the vulcanization of the silicone in the lower part to occur, in the same way, the silicone was inserted into the upper mold and silicone was added to the upper part of the occluder so that

the toy piece is secured (figure 6A, 6B, 6C). After vulcanization, the alginate mold was removed, and the semi-rigid working model was ready (figure 6D).

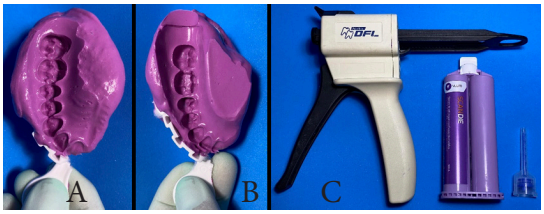

Figure 4: A – Upper impression with Hydrogum 5 alginate. B – Lower impression with Hydrogum 5 alginate. C - Addition silicone for making Scan Die models.

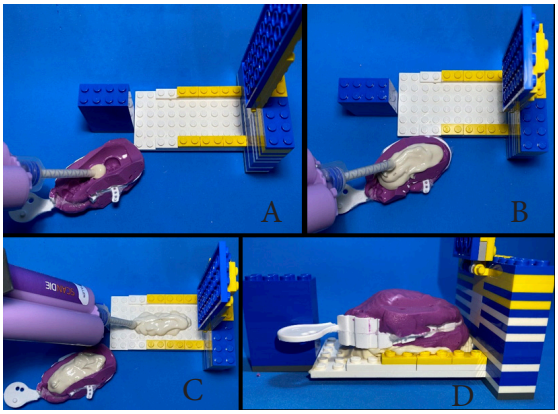

Figure 5: A – Insertion of the addition silicone into the lower mold, first in the preparation region. B – Insertion of the addition silicone into the rest of the mold. C – Insertion of the addition silicone into the occluder base. D – Front view of the mold on the occluder.

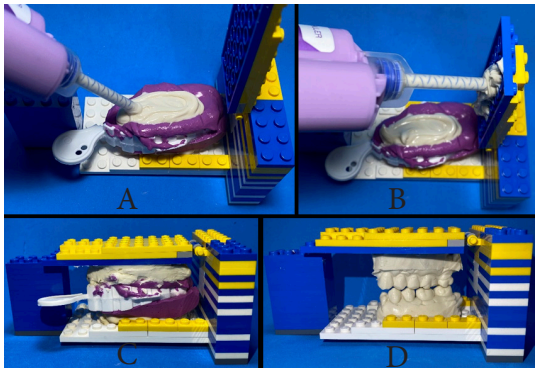

Figure 6: A – Insertion of the addition silicone into the upper mold. B – Insertion of the addition silicone into the upper part of the occluder. C – Front view of the mold on the occluder. D – Front view of the semi-rigid working model.

Die casting proceeded as follows: cuts were made with a #3 scalpel handle (Golgran, São Caetano do Sul, São Paulo, Brazil) and a #15 scalpel blade (Solidor, Osasco, São Paulo, Brazil) in the proximal region of the element 36, preserving the preparation ends, it was removed from the occluder and the structure was replaced (figures 7A and 7B).

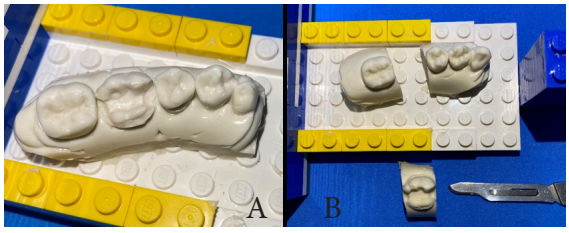

Figure 7: A – Occlusal view of the lower model and preparation on tooth 36. B – Trochelization of tooth 36.

The restoration was carried out in Vittra APS composite resin (FGM, Joinville, Santa Catarina, Brazil) in colors EA2 and DA2, with spatulas for double composite resin nº 1, 3090 and SD2 Millennium (Golgran, São Caetano do Sul, São Paulo, Brazil) (figure 8A), reproducing the original anatomy of the dental element (figures 8C and 8D). The Emitter A Fit photopolymerizer (Schuster, Santa Maria, Rio Grande do Sul, Brazil) (figure 8B) was used for photoactivation for 20 seconds after each increment and, after completion of the restoration, 60 seconds on each face of the restoration, as additional polymerization. The die was replaced in the occluder to perform occlusal adjustments. After occlusal adjustment (figure 9A), finishing and polishing was done using the Ultra-Gloss Kit (American Burrs, Palhoça, Santa Catarina, Brazil), consisting of a coarse-grained Ultra-Gloss polisher (figure 9B), a medium-grained Ultra-Gloss polisher (figure 9C), a fine-grained Ultra-Gloss polisher (figure 9D), a Silicon Carbide Ultra-Brush brush (figure 9E), a Goat Hair brush (figure 9F), all used at low rotation (Saevo, Ribeirão Preto, São Paulo, Brazil). Completed restoration

(figure 10A, 10B and 10C).

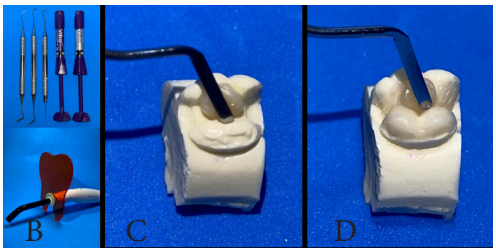

Figure 8: A – Spatulas for composite resin and Vittra APS EA2 and DA2 composite resin. B – Emitter A Fit photopolymerizer (Schuster, Santa Maria, Rio Grande do Sul, Brazil). C and D – Production of the resin restoration.

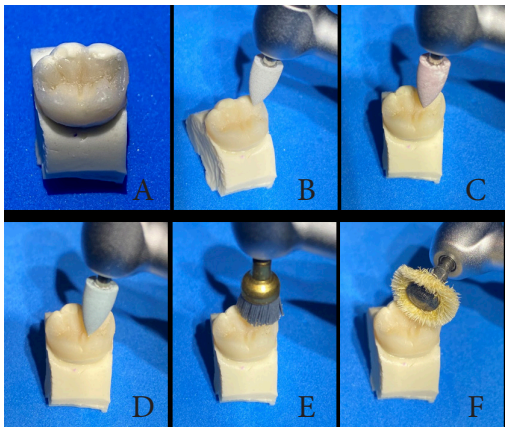

Figure 9: A – Composite resin restoration without polishing. B – Use of coarse-grained Ultra-Gloss polish. C – Use of medium-grained Ultra-Gloss polish. D – Use of fine-grained Ultra-Gloss polish. E – Use of the Ultra-Brush Silicon Carbide brush. F – Use of the Goat Hair brush.

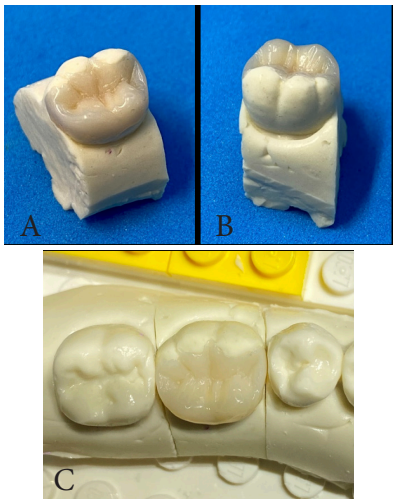

Figure 10: Completed composite resin restoration.

DISCUSSION

Posterior teeth with extensive carious lesions are frequent in the dental surgeon's clinical routine, therefore, attention must be paid to the restorative technique of choice. Alharbi et al. (2014) point out in cases where, after removing the decayed tissue, less than 50% of the coronal remains remain, advantages are already observed in the use of indirect restorations. To simulate a tooth with coronal destruction, an onlay-type preparation was performed on the manikin's tooth, thus making it possible to receive the indirect restoration.

Azeem and Sereshbabu (2018) and Borba et al. (2020) mention in their work that indirect restorations have the advantage of greater surface smoothness, better detail of the anatomy and better marginal integrity. Monteiro et al. (2017) points out the advantage of the indirect technique is the more simplified obtaining of the contact point and the reduction of polymerization contraction, present only at the interface of the cementing agent. Through the technique illustrated in the work, it is possible to directly visualize the proximal surfaces of the dental element, facilitating marginal adaptation, in addition to obtaining the contact point.

Mesquita et al. (2012) points out that to obtain all the advantages that an indirect restoration can offer, it is necessary that the protocol is well executed, starting from a precise impression and a reliable working model. In this present study, alginate was used as the impression material in a double tray in order to obtain both the arch mold and its bite registration. Furthermore, the illustrations and descriptions present in the work make descriptive sequential identification possible so that the details involving the technique used can be seen.

As a result of the excellent physical properties of addition silicone, many studies

use a semi-rigid model of this material (Torres et al., 2017; Teles, 2020; Silveira et al., 2022; Constant et al., 2023). Souza et al. (2018) and Schneider et al. (2024) mention that semi-rigid models facilitate the die-cutting step, in addition to being more agile in obtaining it. Torres et al. (2017) point out in their study that the die provides easier access to the proximal surfaces, enabling better marginal adaptation, finishing and polishing of the restoration on these surfaces.

It is possible to find in the literature the use of a semi-rigid model supported only on a toy part, however, Constant et al. (2023) point out the scarcity of studies using occluders made from toy parts. The present study contributes to reducing the scarcity of this type of study, while serving as a source of research for potential professionals who are interested in the technique and its improvement.

Schneider et al. (2024) illustrates the possibility of checking the points of contact with the opposing tooth while the restoration is being created, reducing the number of adjustments made in the mouth. In the present work, while the restoration was constructed, the die was repositioned to the occluder after each increment, thus checking the points of premature contact with the antagonist tooth.

In their study, Diegues et al. (2017) concluded that composite resins can have the same performance as ceramics, as long as they are correctly indicated, following precise planning and execution. The authors also point out that when choosing the technique, the degree of aesthetic demand and resistance of the material must be considered in relation to the patient's occlusion challenges. Furthermore, Marques and Guimarães (2015) corroborate by saying that the indirect technique with composite resin allows for a longer-lasting and quality restoration at a lower cost for the patient. As a result, the present work sought to present a viable alternative to rehabilitations carried out in prosthesis laboratories, with the use of composite resin in indirect restoration carried out by the dentist himself, maintaining a good cost-benefit ratio for the patient.

Cardoso et al. (2012) points out that the degree of polymerization of the composite resin directly affects its longevity. Borba et al. (2020) warn that polymerization contraction factors are decisive in the longevity of the piece, as they directly interfere with tooth-restoration adhesion. Both authors agree that the greater conversion of organic matrix, that is, converting the largest possible quantity of monomers into polymers, increases the polymerization contraction, which will be compensated at the time of cementation with resin cement, causing the "C" factor to be minimized., thus avoiding marginal maladaptation's that can generate infiltrations and secondary caries lesions. With the technique presented in this study, the polymerization of the composite resin is more effective, as it is possible to carry out direct polymerization on all faces of the restoration.

CONCLUSION

The present work concluded that it was possible to report and clarify the technique for creating an indirect restoration in composite resin, which meets the clinical needs of restoring the shape, function and anatomy of extensively decayed and destroyed posterior teeth.

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