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Bilateral transposition between canine and first premolar: from planning to execution

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ABSTRACT:

Patients seeking for aesthetic dental procedures are increasingly common. Since aesthetics is associated with ones social condition, its improvement can also improve ones self-esteem. Amid dental abnormalities that may impair functionality and aesthetics, there is the dental transposition. It is a rare condition in the eruption of the adjacent teeth, when it occurs, it creates doubts about treatments amongst dentists. Among the alternatives treatments for total transpositions, it was decided to keep the exchanged position and correct function and aesthetics reshaping through composite resin. Conclusion: in cases of total transposition, when both crown and root are exchanged, an efficient and conservative approach is acceptance the malposition and reshaping the teeth with restorative procedures. The composites resins are an excellent alternative, with great aesthetics and good longevity, being a conservative material requiring minimal or no preparation.

Keywords: Composite Resins. Biomimetics. Esthetics, Dental.

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INTRODUCTION

Today's society dictates behavioral and aesthetic patterns, and this has been influencing the search to improve the smile aesthetics. They are altered patterns of shape, contour, color and positioning that interfere both functionally and aesthetically in the day-to-day life of these patients. Dental alterations that lead the patient to functional and aesthetic displeasure may be developmental, such as imperfect amelogenesis, dysplasia, tinting, (among others), as well as dental changes due to environmental factors such as fluorosis, intrinsic or extrinsic pigmentation, wear and tear through attrition, abrasion or abfraction, among others. Among dental abnormalities there is dental transposition, which is a severe disorder in the eruptive position of adjacent teeth.

Dental transposition is a rare condition, with a prevalence rate in the general population of 0.13%-0.4%,[8] which may vary depending on the region[3-9] being the canine and first pre-molar transposition the most common one.[6-8,10,11] Although rare, when found it is of difficult clinical management.[9,12]

When the dental transposition is not diagnosed at an early stage, and being a total transposition, when the crown and the root are in exchanged positions, the prognosis for orthodontic treatment is not favorable.

Due to the high risk of damage to the teeth and their supporting tissues which can result in gingival recession, root resorption, loss of bone tissue and even loss of the dental element. Besides that, it is normally a long period of treatment.[2,13]

In order to rehabilitate these cases of dental transposition within restorative dentistry there are several options such as indirect procedures, ceramics, or direct, composite resin.[14] In fact, ceramics have a high clinical success rate (above 90% in 10 years), but more than a third require restorative reintervention.

Composite resin has excellent aesthetic potential, good longevity and lower cost compared to ceramics. Besides often not needing preparation for its manufacture, and having better result with future repairs and reintervention when necessary.

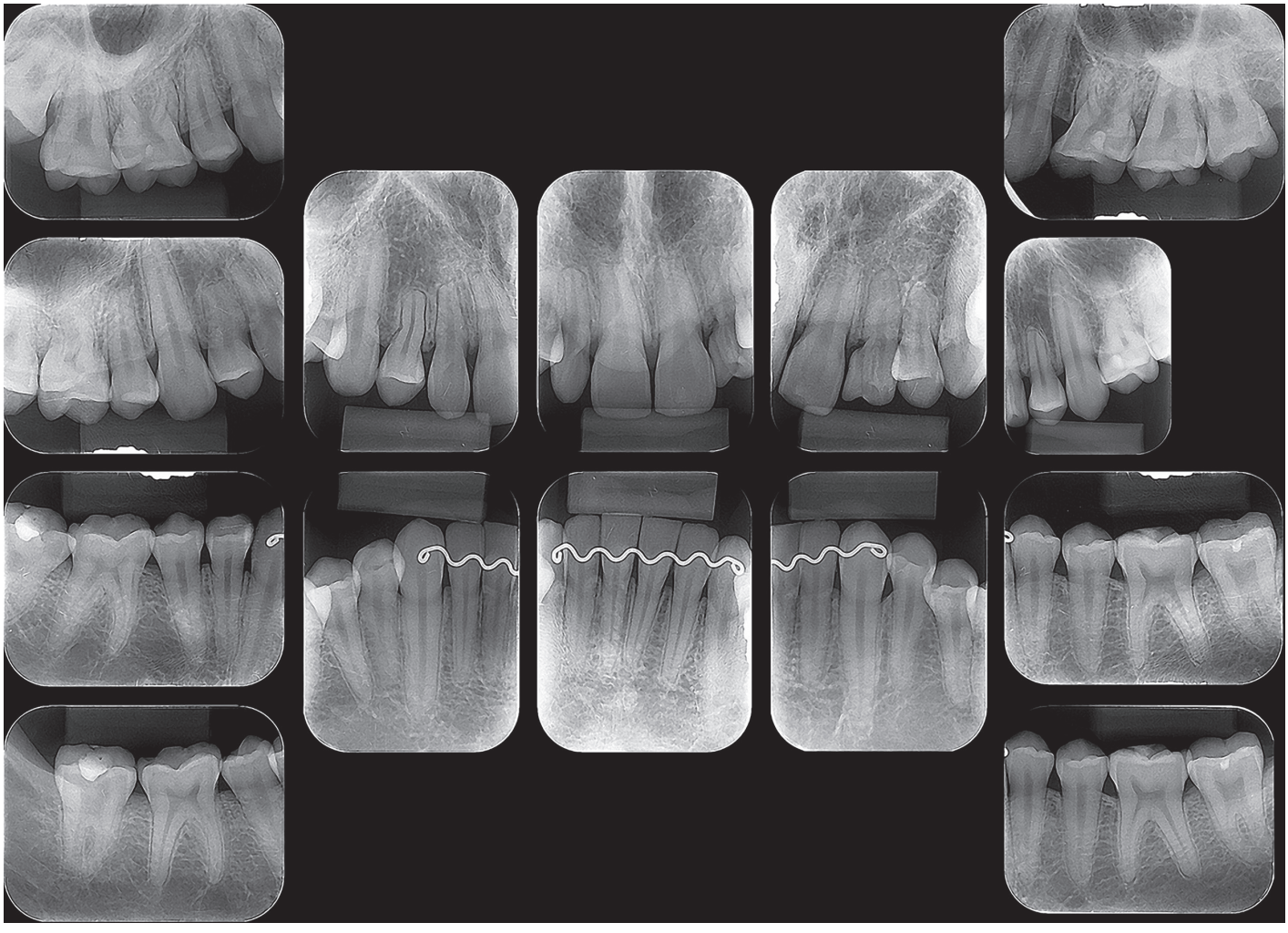
Regarding this topic, composite resin has been gaining space by presenting a less invasive technique. It is part of a new concept that we are experiencing, the 'bio-aesthetics'. It gives priority for treatment additives or non-invasive such as bleaching, micro abrasion, enamel recontour, direct composite resins, and fixed bridge or implants to replace missing teeth.[15]

This article aims to report a clinical case of bilateral transposition between canines and first upper premolars, with the presence of dental fusion in the right lateral incisor, from planning to the execution of restorative treatment with direct nanohybrid composite resin.

CASE REPORT

Male patient, 22 years old, came to a Specialization Course in Restorative Dentistry Clinic unsatisfied with his smile. He had just finished an orthodontic treatment which lasted for 5 years. After a clinical checkup, radiographic exams and an anamnesis, it was verified the presence of bilateral transposition between the upper canine and the first premolar, a fusion on the right lateral incisor, and the absence of the left second premolar (Figs 1, 2, 3, 4, and 5). Considering the fact that he is a young patient and has recently finished the orthodontic treatment, the proposed treatment plan was to maintain the dental order and alignment, perform dental whitening, gum repair, followed by composite resin reanatomization.

↑ **Figures 1 to 4:** Initial photos of the clinical case, with the presence of bilateral transposition between the upper canine and first premolar and shape change in 22.



↑ **Figure 5:** Periapical survey. Note the apical resorptions on the anterior teeth, including the first premolars.

The chosen whitening treatment was the homemade type, made by an individual silicone tray. The patient received instructions to execute the whitening with 16% carmabide peroxide gel syringe to be used for three weeks. After the third week the result was very satisfying (Fig 6).

In the next step, surgery was performed to correct the gengival line of elements 13 to 23. It was necessary to remove both gum and bone tissue (Fig 6).

↑ **Figure 6:** Result of home bleaching and restoration of harmony at the gingival level.

After the cicatrization time process, additive silicone molding was made for the waxing of the 8 elements (Fig 7). Based on the proposed waxing, a condensation silicone matrix was made, which served as a guide for insertion of the resin into the palatine face (Fig 8). The procedure was started on tooth 21 after cleaning with pumice stone and chlorhexidine, 37% phosphoric acid was applied for 30 seconds in enamel, and Single Bond 2 adhesive adaptor (3M_ESPE) with the aid of a microbrush and right after, a slight air jet was applied for solvent evaporation and 20 seconds slight photopolymerization (Bluephase N, Ivoclar Vivadent) was applied after that. Therefore, the first increment with Trans 20 resin was accommodated in the palatal matrix with a small portion of transparent flow resin (Tetric N-Flow Ivoclar Vivadent) for better adaptation between the matrix resin and the tooth (Fig 9). Slight Photopolymerization was applied for 20 seconds, the matrix was removed and another slight activation by the palatal surface was performed.

After that, small resin spikes were removed from the incisal with a scalpel blade. In relation to the central incisor case, the next increment was the opaque halo with Bleach-L dentin (Empress Direct, Ivoclar Vivadent). The portion between the halo and the tooth was filled with Trans Opal resin (Empress Direct, Ivoclar Vivadent) to give opalescence effect on the third incisal. A B1 enamel layer (Empress Direct, Ivoclar Vivadent) was adapted on the entire buccal surface. In sequence, marginal ridges were made with Trans 20 resin (Empress Direct, Ivoclar Vivadent). A last activation was performed with the application of glycerin gel for better photoactivation of the last layer (Fig 10).

→ **Figure 7:** Diagnosis and wax-up models, note the difference in shape and contour given by the wax-up.

Figure 8: Palatal matrix in the mouth, note the incisal increase given by the wax-up.

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Figures 9 and 10: Recontouring tooth 21. The incisor underwent little modification, requiring small increments of resin.

Before starting to work on a different tooth, a red Sof-Lex Pop On sanding disc (3M – ESPE) was used for rough finishing and removal of the last oxygen-inhibited layer in order to reduce the adhesion of the future restoration of the adjacent tooth (Fig 11). The same process was made on element 11 (Figs 12 and 13). In the lateral incisors, a dentin increment was necessary, reproducing dentin mamelum with Dentin Bleach-L (Empress Direct, Ivoclar Vivadent) after the palatal surface adaptation. An opaque halo was made using Dentin Bleach-L as well (Empress Direct, Ivoclar Vivadent), and the space between mamelals and the halo was filled with Trans Opal (Empress Direct, Ivoclar Vivadent). The last layer was B1 enamel (Empress Direct, Ivoclar Vivadent) giving adequate anatomy for the lateral incisors as it can be seen in Figures 14 to 22.

After this, premolars were reanatomized into canines and canines into premolars following the same stratification. In this layering, Trans 20 (Empress Direct, Ivoclar Vivadent) was used for the palatal surface, Dentin Bleach –L (Empress Direct, Ivoclar Vivadent) and Enamel B1 (Empress Direct, Ivoclar Vivadent) (Figs 23 to 26).

↑ **Figure 11:** Abrasive sanding disc before the next restorations to avoid adhesion with resin that will be added to adjacent teeth.

↑ **Figures 12 and 13:** Recontouring tooth 21. Note a small difference in height that will be corrected in the finishing phase.

↑ **Figure 14:** Palatal surface made with Trans 20 (Empress Direct, Ivoclar Vivadent) with the aid of a matrix. It is important that this increment reproduces the contour given by the wax-up.

↑ **Figure 15:** Bleach-L dentin augmentation (Empress Direct, Ivoclar Vivadent) for characterization of dentin mammels, and insertion of the opaque halo at the incisal edge. The space between them was filled with Trans Opal (Empress Direct, Ivoclar Vivadent). This will give areas of opacity and translucency, giving naturalness to the restoration.

↑ **Figures 16 and 17:** B1 enamel layer (Empress Direct, Ivoclar Vivadent). The polyester strip was adapted mesial and distal to provide contour and a better contact point.

→ **Figure 18:** Tooth 12 completed.

← **Figure 19:** For better adhesion, light preparation was necessary in the altered area of tooth 22, as with only the acid etching, it was not possible to observe demineralization in this area.

↑ **Figures 20. 21 and 22:** Stratification tooth 22, following the same steps as the right lateral incisor.

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↑ **Figures 23 and 24:** Reanatomization of the right first premolar in a canine. In this restoration, the Bleach-L dentin (Empress Direct, Ivoclar Vivadent) was positioned all over the face, starting the anatomy of a canine. Then B1 enamel (Empress Direct, Ivoclar Vivadent). Since the canine does not have characterization of mamelal incisal part.

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↑ **Figures 25 and 26:** Reanatomization of the left first premolar in a canine. This restoration followed the same steps as tooth 14. A single layer of Bleach-L dentin (Empress Direct, Ivoclar Vivadent) and a layer of B1 enamel (Empress Direct, Ivoclar Vivadent).

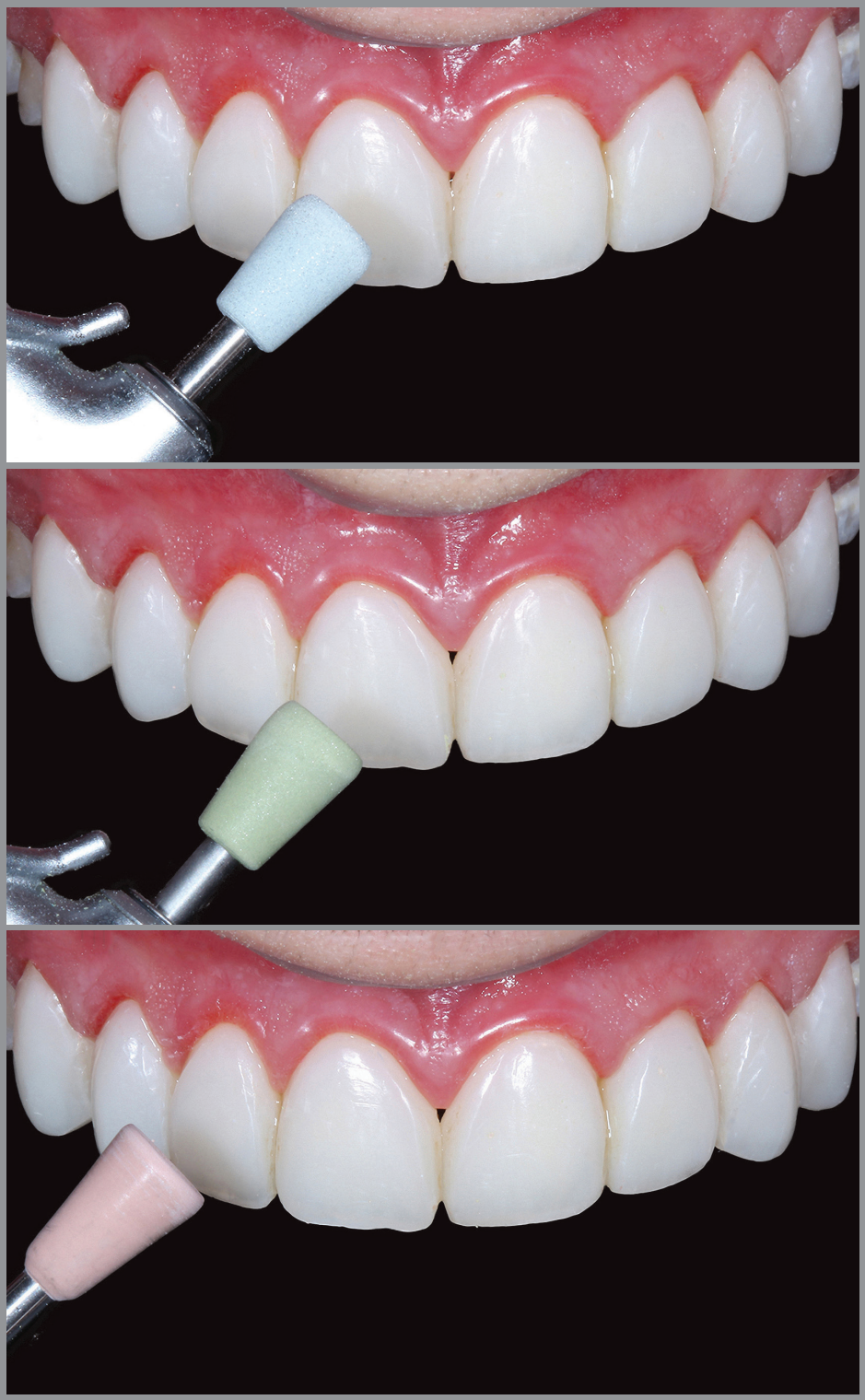
The anterior and canine guides were checked and adjusted. Laterality was restored in group (between canines and premolars), due to canines transposition.

For the initial finishing, excess resin and adhesive were removed from the cervical region close to the gum with a number 12 blade. The red Sof-Lex sanding disc (3M-ESPE) was used to give better contour and anatomy, as well as to improve the mirroring and the reflected light area. To assist the mirror vision areas, marginal ridges, pencil and dry tip compass were used (Fig 27). With the macro anatomy defined, the characterization of the micro anatomy was made. Developmental and perichycete grooves were designed with multilaminated and diamond drills, respectively.

Polishing was done with gray, green and pink rubber tips (Astropol – Ivoclar Vivadent), in the respective order (Figs 28, 29, 30). The next ones were finished with thin and extra thin Epitex (GC) strips (Figs 31 and 32). After this, Flexibuff disk (Cosmedent) with Enamelize (Cosmedent) paste was applied (Fig 33).

↑ **Figure 27:** Characterization of restorations. Note the red lines that help to visualize the crests and mirror areas, which are compared with a compass. The blue lines will be worn to make the development grooves.

Figures 28, 29 and 30: Polishing phase made with gray, green and pink abrasive rubbers (Astropol, Ivoclar Vivadent), in this order for initial polishing.



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← **Figures 31 e 32:** Proximal finishing. Strips of fine and extra-fine sandpaper (Epitex - GC) with "s" movement so as not to damage the point of contact made with the restorations.

← **Figure 33:** Felt disc (Flexibuff - Cosmedent) with diamond paste (Enameliza - Cosmedent) for polishing and final shine of the restorations.

After finishing the whole treatment, harmony was re-established, as well as confidence and self-esteem which lead the patient to happiness and a beautiful smile (Figs 34 to 38). Note that the maxillary second premolar and the maxillary first molar were not included in the esthetic planning, due to the patient's desire (Figs 35 and 36).

↑ **Figures 34, 35 and 36:** Final photographs of the 8 restorations.

↑ **Figure 37:** Final photographs of the 8 restorations. Harmony was restored as well as confidence in smiling by the patient.

↑ **Figure 38:** Comparison of the smile before (**A**) and after (**B**).

DISCUSSION

Dental transposition is a condition in which adjacent teeth are shifted. True transposition is considered when both parts, crown and root, exchange positions.[1] It is considered a rare anomaly, but when it happens it impairs the patient's function and aesthetics. Among the researches, all authors corroborate that it is a rare condition, with a rate ranging from 0.09% to 2% in the population studied.[4-8,10] Only one survey found a higher rate of 15% of transposition, but associated with Down Syndrome.[11] Some authors found a higher prevalence in women,[5,6,7] while others in men[8,16] as well as no statistical difference between both sexes.[4] It is consensual that among transposition cases, there is a higher rate involving the canine tooth and first premolar.[4-9,17]

Many researches have been done in order to find the etiology of transposition between the canine and first premolar, but the cause is still uncertain. It was believed that the higher incidence of transposition between the canine and the first premolar was due to the long way for the canine's eruption, besides the longer time of eruption, with a limited area and denser palatal bone along with retention of the deciduous canine, hereditary factor and bone pathologies as well such as cysts.[9] However, new research has indicated that canine retention, which is often found concomitantly with transposition, is not the cause but a result of it. The genetic factor has been presented as a strong indicator of the etiology of this anomaly. The genetic condition has been highlighted due to the variation in the incidence of transposition between different races, the high coincidence with other dental anomalies, a moderate bilateral rate, differences in sex, and the presence of a family pattern.[2,10,16-19] Further research is still needed to better define this etiology.[19]

Regarding the treatment of this condition, the authors agree that an early diagnosis is essential for a less invasive treatment with a better prognosis. This diagnosis must be made between the ages of 6 to 8 years old, and when made, the preferred treatment option is orthodontic interception.[12,13] When the diagnosis is late and the transposition already happened, there are some treatment options: 1) first premolar extraction, when there is a discrepancy between the size of the arch and the teeth, and teeth alignment; 2) non-extraction and orthodontic alignment to change positions and correct the transposition; 3) maintain the changed position and correct function and shape with prosthetic/restorative treatments. Often, besides the final restorative treatment, it is necessary to correct gum discrepancy with periodontal treatments, in addition to endodontic treatments when it is necessary to remove the palatal cusp of the first premolar because it interferes with occlusion. Although orthodontic treatment is often the least invasive, one must take into account the longer treatment time to correct the transposition. Besides the high damage risk of the supporting tissues, which can cause gum retraction, root resorption and bone loss.[2,12,13,18] Despite of highly risking the supporting tissues, some authors opt for orthodontic treatment to correct an already existing transposition. Treatments last for more than thirty months, and end up with scars such as root resorption

and bone loss.[20,21] In order to avoid these sequels, one of the alternatives is to maintain the changed order of transposition and restore function and aesthetics with restorative procedures. It can be done with a prosthesis, indirect or direct facets, depending on each case.[22-25] It is important to not forget that we must always take into consideration all risks and the patient's wishes, for a better indication and prognosis of each case.

In the actual clinical case, the choice of reanatomization treatment using composite resin was due to a few factors: the patient is young and had already undergone an orthodontic treatment that lasted for five years, which maintained bilateral transposition, also presenting a small resorption at the root apex of incisors, canines and premolars. Based on this data, another orthodontic treatment was not considered, as the risk of damage to the supporting tissues would be high, and the patient was unwilling to wear braces again. In order to improve aesthetic and functional condition, the chosen treatment was cosmetic contouring using composite resin.

Composite resin has gained great prominence in Contemporary Restorative Dentistry, as it is a material that has excellent esthetic quality, good longevity, and great repair capacity, usually not requiring any preparation for the procedure, which makes the procedure more conservative.[15,26-31] It is considered the star of minimally invasive dentistry in restorative dentistry.[26]

To obtain maximum success in treatments with this material, it is necessary to know well the dental structure and its optical characteristics, as well as the materials, besides artistic ability to reproduce all the details.[15,32] The tooth has a polychromatic structure, where dentin enamel and pulp interact differently with light. This final result is extremely complex and difficult to reproduce with artificial materials.[15,32,33] Based on this optical concept of the tooth and materials, several techniques are presented to try to facilitate the reproduction of all details.[15,32] All of them separate the structure of dentin and enamel, to choose the material that presents compatible opacity, translucency and fluorescence characteristics. Some of them are "simpler" systems with only two layers, which would be one of dentin and another of enamel; others more complex, with dye layers, incisal and surface effects. Although each one has an advantage, the technique choice must be individually made by each professional. The surgeon must be able to identify each case and know how to reproduce the lost structure through the wide spectrum of techniques and materials.[34]

With the development of resins with better mechanical and optical properties, there are many cases in which they are indicated. Mainly in orthodontic finalization process, since small additions of material are normally necessary without wear and preparation of the teeth.[27]Perhaps, commonly, we will find cases where the combination of direct and indirect materials is a better solution, providing greater efficiency and economy.[26]

The clinical success of composite resin treatments is also linked to their longevity. There is little data confirming the good behavior of modern composites used in anterior teeth.[15] However, the found ones give a good prognosis, with a success rate of 89% in five years of follow-up.[29,35] There are several factors that influence restoration longevity, such as adhesive choice and application, resin type and technique used, as well as the patient's diet, oral hygiene, parafunctions and occlusion.[36] In most cases, the replacement of anterior restorations occurs due to fractures of the restoration and/or the tooth, color change, margin incompatibility.[28,29,35,36] Despite of this, composites are still the best choice for small restorations and esthetic improvements, particularly when a large part of the tooth surface is intact.[25]

A great advantage of resins is its ability and success in restoring repairs.[30] The first choice of treatment, when indicated, should always be repair as it is the least invasive treatment with a good prognosis, and which consistently increases restoration longevity.[35] The repair resin does not necessarily need to be the restoration resin already installed. Studies show that there is no difference in shear bond strength for different composites and adhesives but what determines the effectiveness of the repair in terms of longevity is the age in which the restoration is in the mouth. The older the restoration, the worse the longevity of the repair made on it.[31]

CONCLUSION

Based on the literature, we can conclude that in cases of total transposition, when both crowns and roots of adjacent teeth are in exchanged positions, an efficient and conservative treatment alternative is to maintain the exchanged order and re-anatomize the teeth with restorative materials. This treatment was performed in the presented clinical case, enabling function and esthetics restoration. The choice of material for composite resin was because it is a material with good mechanical and aesthetic quality, and mainly because it is a conservative material. The resin needs minimal or no dental preparation, besides being easily repaired, with effective longevity in recent repairs.

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