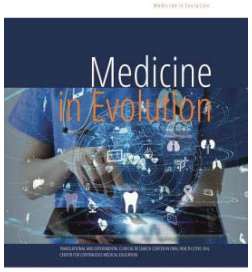
Extensive prosthetic rehabilitation in accordance with ceramic masses



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Abstract

The purpose of this study was to demonstrate the fact that today the clinician will have to use ceramic masses according to their indications and contraindications. Nowadays the therapeutic decision when making a treatment plan is largely based on the socio-economic status of the patient. But even when this aspect does not represent a problem, clinicians will have to choose ceramic masses based on their advantages, minimizing or removing from the treatment plan ceramic masses that are not reliable in the long term. Respecting these aspects, patients will be able to benefit from minimally invasive treatments throughout their lives, conserving as much as possible of the remaining hard tissue over the years.

Keywords: ceramic masses, minimal invasive, treatment plan.

INTRODUCTION

As for fixed dental prosthetics, the materials and procedures used in this branch of dentistry have improved over the years. Along with its development, the options regarding the materials from which dental restorations are made have also increased in number. The aim of this paper is to provide a comparison between different restorative materials that have been developed over time and their application in restorative prosthetics.

When dentists have to deal with a situation where they have to restore a tooth or a group of teeth, the problem of choosing the restorative material always arises (1). Traditional metal-ceramic restorations have proven over time that they can have predictable strength (2), an aesthetically pleasing appearance, and long-lasting oral health (3). In the case of metal-ceramic restorations, fixation is based more on the geometry of the abutment than on the adhesion process itself (4). Even if the resistance of metal-ceramic restorations is enviable, some studies show that the cracks that appear most often are at the level of the coronal ceramic layers (5). Regarding the criteria for preparing the teeth, in order to facilitate the fixation stage, there must be a single axis of insertion, and the occlusal convergence must be brought to a close value between 6° and 8° (6,7,8).

Regarding all-ceramic restorations, due to the 100% adhesive fixation at the enamel level, these types of restorations offer a very low amount of microleakage that has a major impact on the resistance of the restorations over time. But this reduced amount is maintained in situations where the adhesion will be 100% at the level of enamel, because a greater amount of microleakage was observed in veneers with cervical edges placed at the level of dentine (9). A study carried out on 66 patients shows us that the success rate of veneers fixed on preparations made entirely at the level of the enamel is 99%, while in situations where the preparation was made marginally at the level of the enamel, the success rate reached the percentage of 94% (10). Other authors have discussed the fact that approaching the preparation strictly at the enamel level is an essential factor to be able to achieve an adhesive fixation and to have a much more durable result over time (11,12).

Although there are several types of materials from which feldspathic ceramic restorations are made and several techniques, the most commonly used technique is the refractory mass model with refractory abutment technique in which the technician loads the ceramic through an additive process applying successive layers (13). The major disadvantage of feldspathic ceramics is mechanical resistance. Depending on the conditioning of the restorations, the sequence and the materials used, the mechanical strength is approximately around 100-140 MPa (14).

Lithium disilicate is composed of very small needle-shaped crystals (3-6 μm x 0.80 μm) embedded in a glass matrix with a volume of 1% porosity (15). This situation occurs most often when the patient wants the new restorations to be lighter in color. In this situation the clinician will need to remove 0.2 mm to 0.3 mm of dental hard tissue for each shade (16). The difference between the colors is obtained by dispersing some ions (staining ions) in the glass matrix at different levels of translucency depending on the distribution of the clinical case (17). The success rate of these types of restorations can be classified as less than 10% failure at 10 years (18). Regarding the indications of zirconium oxide compared to restorations made of lithium disilicate and those made of feldspathic ceramics, its applicability has a wider spectrum taking into account the qualities of the material. The mechanical properties of zirconium oxide provide a flexural strength of 900 to 1200 MPa (19). All ceramic masses are used in the given conditions and for the preparation of dental hard tissues. These conditions are provided by the preparations that the dental clinician will have to perform. Depending on each type of ceramic table, there is a certain preparation that must be carried out, but this will

depend on the remaining hard dental substrate, the patient's complaints regarding color and the forces exerted in that area of the dental arch. Regarding the dental surfaces, the chosen material will have to be combined with a certain type of veneer preparation (20).

Aim and objectives

The purpose of this study was to demonstrate that in certain situations where clinicians do not take into account the indications and contraindications of restorative materials, they can have repercussions on the patient both in the short term and in the long term. The most common complications in the short term are represented by chipping, and in the long term a standard in this sense is represented by the preservation of the hard dental structures of the teeth.

MATERIAL AND METHODS

In the case of dental trauma, the training of clinicians in terms of therapeutic possibilities plays a very important role. This is based on thorough knowledge regarding the advantages and disadvantages of each individual ceramic mass. A patient presented with a trauma at the level of dental units 1.1 2.1 which causes an emergency in dentistry.

Figure 1. The initial aesthetic appearance of the teeth after their fracture

The only pre-prosthetic treatments that were performed in this case were sanitization and professional brushing. After sanitizing and professional brushing, I performed the aesthetic analysis of the case. In this case, we did not use a wax-up because the patient had to leave the country as soon as possible. With the help of the aesthetic analysis, we planned the future contours that should be incorporated into the final restorations. Regarding the all-ceramic systems from which the final restorations would be made, we had 2 possibilities. We could make the final restorations either from lithium disilicate-supported ceramics or from feldspathic ceramics. Due to the exclusive front area, we could not choose a restoration on a zirconium oxide support because this type of restoration compromised our aesthetics. Even if it compensates for the strength of the frontal area where the upper central incisors are part, they must not present very strong contacts. It is even contraindicated to reconstruct the frontal area with strong contacts. So the decision had to be made according to the 2 all-ceramic systems left, namely: lithium disilicate and feldspathic ceramic. We encounter a case

where aesthetics prevail. The material that can offer us the highest aesthetic qualities is feldspathic ceramics. And lithium disilicate-based ceramics have very good aesthetic properties, but in this regard, no other all-ceramic system can compare with feldspathic ceramics. So for this case, the option chosen for the restorative material was feldspathic ceramic. I chose feldspathic ceramic to be able to make some restorations that will not be noticeable. The properties of feldspathic ceramics can enable such achievements. It can be observed at the level of 1.1 and 2.1 the lack of dental hard substance. The strategy for this case was that after obtaining the feldspathic ceramic restorations, we would respect the principle of mutual protection, at the same time creating an inocclusion space at the level of the upper central incisors to stress them as little as possible during the act of mastication.

Figure 2. The intraoral aspect from the frontal norm

After the decision on the restorative material was made, we moved on to the next stages of the prosthetic treatment. Compared to the other cases where preparations were performed or a no-prep technique was approached this case was a little more special. Considering the type of ceramic table used, I had the opportunity to approach a different type of preparation. In this case (Figure 3), the purpose of the preparation was to smooth the hard dental surfaces. The smoothing was performed respecting the insertion axis of the future restorations.

Figure 3. Smoothing of remaining hard tooth surfaces

Smoothing was done with arkansas tools. The surfaces were smoothed to facilitate a 100% adhesive bond to the enamel. The patient was anesthetized to facilitate the insertion of

the gingival retraction wires. In this case, the 2-wire gingival retraction technique (Ultrapack, Ultradent) was used.

The impression was taken with silicone with addition reaction in two consistencies, namely medium consistency and light, lower consistency (3M ESPE).

In order for the dental technician to be able to make such a prosthetic restoration, the impression materials must necessarily be very faithful. This type of restoration includes surfaces where the thickness of the material reaches up to 0.2 mm. For the fixing stage I used the dike. The feldspathic ceramic veneers were fixed with Variolink Esthetic composite resin (Ivoclar/Vivadent). The type of fixation performed was the adhesive one. To condition the veneers, I started by washing them with water and air drying them. After that I switched to applying hydrofluoric acid for 60 seconds. (IPS Ceramic etching gel HF 3% to <7%-IPS Ceramic; Ivoclar/Vivadent) After the application of hydrofluoric acid, the veneers were placed for 60 seconds in a place protected from possible interference with other liquids or other bodies. After the 60 seconds, the veneers were also washed with water. Then the conditioning continued with orthophosphoric acid 37%-orthophosphoric acid (Total Etch; Ivoclar/Vivadent). After applying the orthophosphoric acid for 60 seconds the restorations were washed and dried and the next part of the conditioning was carried out. The veneers were then silanized with silane (Monobond Plus; Ivoclar Vivadent) for 60 seconds. After that I performed the conditioning of the teeth. The surface of the teeth was conditioned by sandblasting with aluminum oxide particles. After that, 37% orthophosphoric acid (Total Etch; Ivoclar/Vivadent) was applied for 45 seconds to the enamel surface of the teeth. I continued with bonding, namely with Adhesive Universal (Viva Pen, Ivoclar Vivadent). After brushing for 20 seconds, I let the surfaces dry and light-cured for 10 seconds on each individual tooth. Fixation of the restorations was performed with Variolink Esthetic (Ivoclar/Vivadent). With the help of a dry brush I removed the excess cement. Then we moved on to finishing the marginal closure. After finishing the marginal closure, we performed the occlusal echilibration.

Figure 4. Aesthetic appearance after fixation and occlusal echilibration

Unlike the other cases, this patient did not have time to be recalled. This happened because the patient called for an appointment. The patient claimed it was an emergency so she was scheduled as soon as possible. At the visit, the urgency could also be observed from a clinical point of view. As can be seen in Figure 4.9, dental unit 1.1 is fractured. From the image we can see that the fractured surface would be totally part of the structure of the

restoration, being 100% feldspathic ceramic. Even though the group of teeth 1.1 and 2.1 was taken out of occlusion through occlusal echilibration, it did not cope with certain incisal forces. The positioning and angulation of the teeth did not provide an advantage for a material like feldspathic ceramic in this situation. The chances of the other restoration fracturing were quite high so we had to rethink the treatment plan for this situation. The only remaining solution that would provide a suitable aesthetic was represented by lithium disilicate.

Figure 5. Aesthetic appearance after fracture of feldspathic ceramic

The restorative material that would follow the feldspathic ceramics was a ceramic crown on a lithium disilicate support. By changing the restorative material, we should also change the type of preparation performed. For the preparation in order to fix lithium disilicate crowns, we used modified chamfer diamond tools. Code green was used to make the guide grooves and to quantitatively remove dental hard tissue. For finishing I used code red along with rubber bands and arkansas tools.

Figure 6. Preparations obtained for lithium disilicate supported crowns

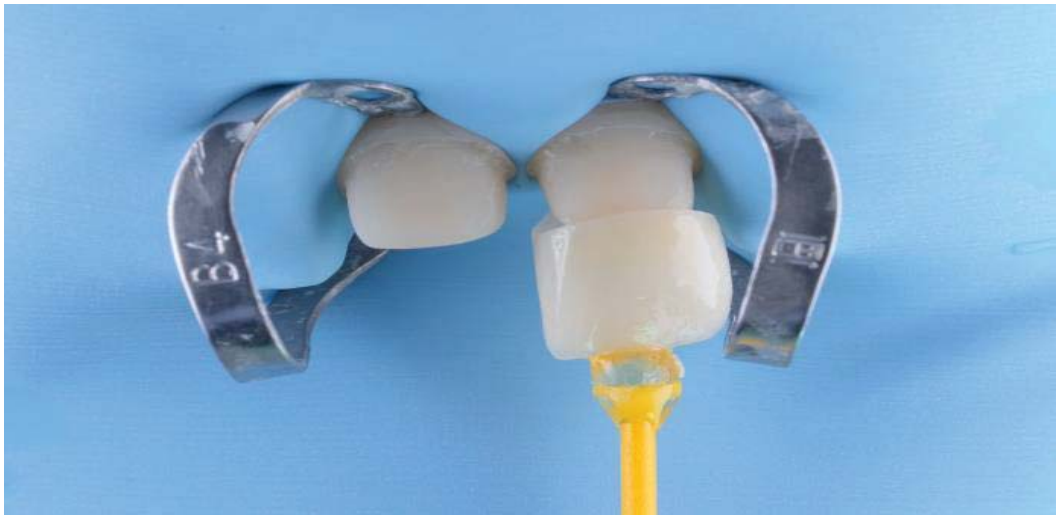

Figure 7. Insertion of the lithium disilicate restoration on the prosthetic field

After the new lithium disilicate ceramic restorations were made, the next steps were the conditioning of the abutments and the restoration, as well as the fixation that was done with the rubber dam.

During the recall all the restorations were intact. After inspecting the restorations we found that they did not show chipping, discoloration or other complications.

Figure 8. The patient's smile at the recall

RESULTS

The patients who participated in this study were between the ages of 16 and 51. The average age of the patients who participated in the study was 34.75 years. Regarding the survival rate of restorations from all 4 systems of which they are a part, namely 3 all-ceramic systems (feldspathic ceramic, lithium disilicate-supported ceramic and zirconium oxide-supported ceramic) and the metal-ceramic system obtained the following results. In total we had a number of: -16 fixed unidental restorations made of feldspathic ceramic (integral) -10 fixed unidental restorations made of ceramic on a lithium disilicate support -12 fixed restorations made on zirconium oxide support (which include unidental and multidental

restorations) -13 fixed restorations made of metal-ceramics (which include unidental and multidental restorations).

Of the total of 51 restorations including all the cases presented in the special part, only 2 restorations were considered a failure although only one of these restorations was fractured. The total number of restorations that can be considered a success from a prosthetic point of view is 49 restorations, which determines a survival rate of restorations from the 3 all-ceramic systems together with the metal-ceramic system of 96.07%. Regarding all-ceramic systems, failures have been recorded with feldspathic ceramic restorations. Out of a total of 16 feldspathic ceramic restorations, 2 of these were considered failures.

DISCUSSIONS

Following this study, it was found that the survival rate of restorations made of all-ceramic systems is very high (96.06%). Moreover, we demonstrated how an integration of several all-ceramic systems does not decrease the long-term success rate of restorations, even if we use all-ceramic systems that do not have a very high structural resistance, but which from an aesthetic point of view bring a plus that patients appreciate. Patients appreciated the quality of the materials even in the situation where the restorations had to be redone, as was the case with the 2 feldspathic ceramic veneers.

Regarding the feldspathic ceramic restorations, the calculation was made as follows:

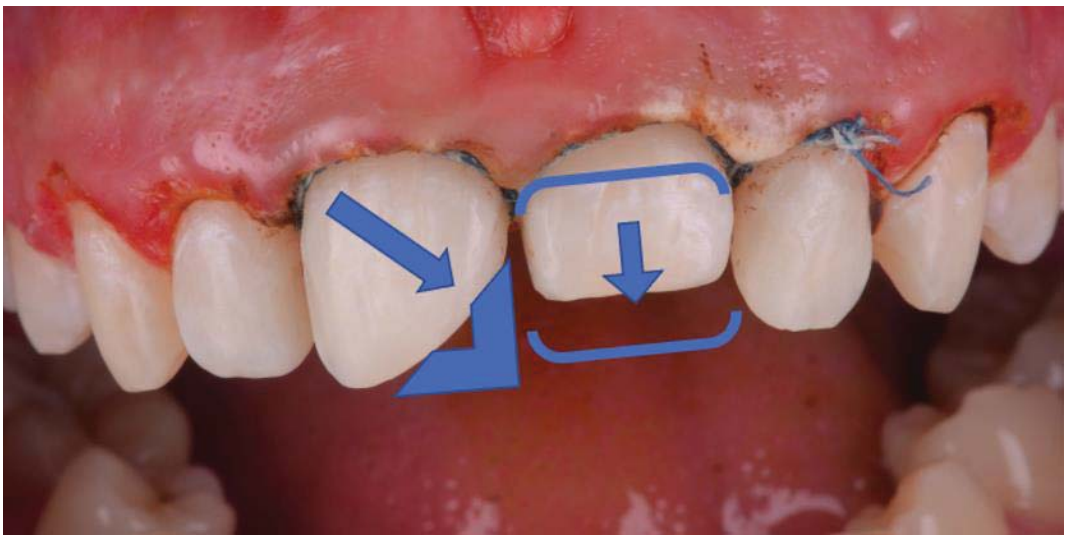

Figure 9. Planning the restorative material

The amount of dental hard tissue was approximately equally distributed across the restoration on tooth 2.1. However, a lack of hard dental tissue on the diagonal can be observed at 1.1. This lack of tissue results in an unsupported restoration surface. When there are larger portions of unsupported feldspathic ceramic in those areas, stress will be exerted and the higher stress will not be able to be distributed across the enamel. These forces will only exert pressure on the material. For this reason, feldspathic ceramic restorations are considered insufficiently strong when the ceramic has to be extended more than 2 mm from the tooth surface. When we look at the situation as a whole, we can say that the success of the restorations within these 4 systems depends on certain factors, among which the selection of the ceramic mass is also a part. In order for a clinician to be able to choose these ceramic masses correctly, sufficient information is needed about each type of material that the clinician must master very well. This will help him to choose the most suitable ceramic table

for each individual case. Once these concepts are mastered the relationship with the patient is much better due to his involvement and giving him the opportunity to have a point of view on the new restorations he will receive.

CONCLUSIONS

When clinicians know very well the properties of ceramic masses, the treatment options for different cases will have a much higher success rate compared to situations where these ceramic masses are made without respecting the indications and properties they possess. Once a clinician has a good grasp of the indications, contraindications and properties of each individual material, in addition to the fact that the percentage of success will increase, the benefits will also materialize in terms of patient satisfaction. Even if a clinician will have to prepare much more, both theoretically and practically, to know the ceramic masses and to make the preparations according to each individual ceramic mass, the clinical results and successes will mean much more to him.

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