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INTRAORAL REPAIR IN METAL-CERAM IC PROSTHESES: A CLINICAL REPORT.

REPARO INTRAORAL DE PRÓTESES METALO -CERÂMICAS : UM RELATO DE CASO CLÍNICO .

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ABSTRACT

Repairing fractured metal-ceramic prosthesis is a treatment alternative that can increase the restoration longevity, preserve dental structure, and/or the integrity of implant components, besides being a simple, low-cost technique. However, clinicians often see restoration repair as a challenge because of the many doubts regarding the procedures required to obtain satisfactory results. Therefore, the motivation to write this article is the need to provide instructions for clinicians dealing with a situation involving fractured porcelain, presenting an intraoral repair technique that can be used in cases of a fractured ceramic veneer of a fixed partial prosthesis. The technique consisted in treating the remaining ceramic surface and applying a microhybrid composite resin following the steps of a protocol that, according to scientific evidence, has promoted high bond strength to porcelain, in addition to being cost effective.

DESCRIPTORS: Dental prosthesis repair • Composite resin • Shear bond strength • Metal ceramic alloys.

RESUMO

O reparo de próteses metalocerâmicas, quando a cerâmica encontra-se fraturada, e um tratamento alternativo que pode aumentar a longevidade dessas restaurações, preservar a estrutura dental ou a integridade de componentes protéticos sobre implantes, alem de ser uma técnica simples e de baixo custo. No entanto, essa técnica, geralmente, e vista como um desafio pelos cirurgiões-dentistas uma vez que não ha um protocolo clinico bem estabelecido para a obtenção de resultados satisfatórios. Assim sendo, o objetivo deste artigo e prover instruções para os clínicos lidarem com situações de fratura da cerâmica por meio da apresentação de um caso clinico, no qual uma técnica de reparo intra-oral indicada para essa situação foi empregada. Essa técnica consiste em tratar a superfície da cerâmica remanescente e aplicar uma resina composta microhibrida, seguindo os passos de um protocolo que, de acordo com evidencias cientificas, tem promovido alta resistência de união, alem de apresentar um baixo custo.

DESCRITORES: Reparo de próteses • Resina composta • Resistência de união ao cisalhamento • Ligas metalo-cerâmicas.

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INTRODUCTION

Metal-ceramic prostheses are often used in oral rehabilitation due to the high mechanical resistance and satisfactory aesthetics they provide (Chung and Hawng[6] 1997, Haselton *et al.*[8] 2001, Ozcan[12] 2006, Ozcan and Niedermeier[14] 2002, Tulunoglu *et al.*[20] 2000). However, despite the advanced development of the material and techniques involved in fabricating this type of restoration, fractures to the ceramic veneer remain rather common (Galiatsatos[7] 2005). These fractures can result from: traumas (Chung and Hawng[6] 1997, Lotta and Barkmeies[10] 2000, Ozcan[12] 2006, Pameijer *et al.*[17] 1996), inappropriate occlusal adjustment (Chung and Hawng[6] 1997, Lotta and Barkmeies[10] 2000, Ozcan[12] 2006), parafunctional habits (Lotta and Barkmeies[10] 2000, Ozcan[12] 2006), flexural fatigue of the metal structure (Lotta and Barkmeies[10] 2000, Ozcan[12] 2006, Ozcan and Niedermeier[14] 2002), incompatibility of the thermal expansion coefficient between ceramic and metal structure (Ozcan[13] 2003), adhesive bond failure (Ozcan[12] 2006), inadequate reduction of the dental preparation (Chung and Hawng[6] 1997, Ozcan[13] 2003, Ozcan and Niedermeier[14] 2002), ceramic porosities (Ozcan[12] 2006, Ozcan and Niedermeier[14] 2002), and inappropriate coping design (Chung and Hawng[6] 1997, Ozcan[12] 2006, Ozcan and Niedermeier[14] 2002).

Although fracture does not necessarily mean the restoration is lost, a fractured restoration is an aesthetic and functional dilemma for both dentist and patient (Ozcan e Niedermeier[14] 2002), and, therefore, treatment is called for.

Repair is a possible solution for cases in which the fractured restoration presents satisfactory adaptation and preserved periodontal integrity (Pameijer *et al.*[17] 1996). Repairs are a simpler alternative, since replacing the prosthesis demands more time, is more expensive, and implies risks of unnecessary wear to the dental structure or even the replacement of prosthetic components in cases of implant-supported prostheses.

Intraoral repairs include techniques that use composite resin applied directly to the fractured restoration (Galiatsatos[7] 2005) with the aim to reestablish function and aesthetics (Haselton *et al.*[8] 2001). To ensure a strong and stable bond of the resin to the fractured restoration substrate, surface treatments must first be performed (Tulunoglu *et al.*[20] 2000). These treatments can promote mechanical or chemical bonding, or both. The indication of a specific surface treatment depends on the substrate to be restored (metal and/or porcelain) (Haselton *et al.*[8] 2001, Lotta and Barkmeies[10] 2000). However, due to the number of surface treatments that can be employed on repair procedure, the dentist usually becomes confused on how to make the best choice.

Regarding repair material, per se, there currently are product "kits" with a protocol defined specifically for the repair in metal-ceramics, such as the systems Clearfil SE Bond (Kuraray Med. Inc. Ltd., Osaka, Japan), Bistite II DC (Tokuyama Dental Corp., Tokyo, Japan), and Cojet (3M ESPE Seefeld, Germany). However, some of these products are very costly.

With the purpose to instruct clinicians dealing with a fractured metal-ceramic restoration, this article presents a simple and effective intraoral repair technique using materials easily found in the dental office.

CASE REPORT

A 59-year-old woman was referred to the prosthodontic department in Araraquara Dental School, Sao Paulo State University [Faculdade de Odontologia de Araraquara] (UNESP) for treatment. Her main complaint was poor aesthetics due to a fractured fixed metalceramic prosthesis. According to the patient's report, a trauma caused the fracture. The clinical examination confirmed the presence of a fracture involving only the porcelain, in the incisal third of the labial surface of number tooth 11 of a 3-unit fixed partial prosthesis supported on implants number spanning teeth numbers Martinlinna *et al.*11 2006, 21 and 22 (Figure 1), fabricated three months earlier. Observe, in figure 1, the use of artificial gums on porcelain to correct the impaired aesthetics.

The examination also verified there was good clinical adaptation of the restoration, integrity of the implants, and no occlusal trauma. The patient was informed about treatment alternatives, and, after all options were discussed, she decided on an intraoral repair using composite resin.

To perform the intraoral repair, the prosthesis region was completely isolated using a rubber dam. Providing complete isolation is very important because it protects the patient during airborne particle abrasion in addition to avoiding the contact of restorative materials with oral moistness.

The following steps were performed:

1) The fractured surface was subjected to airborne particle abrasion with 50 μm aluminum oxide (Bio-art

Fig. 1 – *Frontal view of the clinical case.*

Fig. 2 – *Airborn particle abrasion with 50um aluminum oxide.*

Fig. 3 – *Etching with phosphoric acid at 37% for 15 seconds*

Equip. Odontologicos Ltda, Sao Carlos – SP - Brazil) by means of a microjet (Bio-art Equip. Odontologicos Ltda, Sao Carlos – SP - Brazil) (Figure 2), and air-blown to remove the excess powder

2) Etching with phosphoric acid at 37% (3M ESPE, St. Paul – USA) for 15 seconds for surface cleaning (Figure 3)

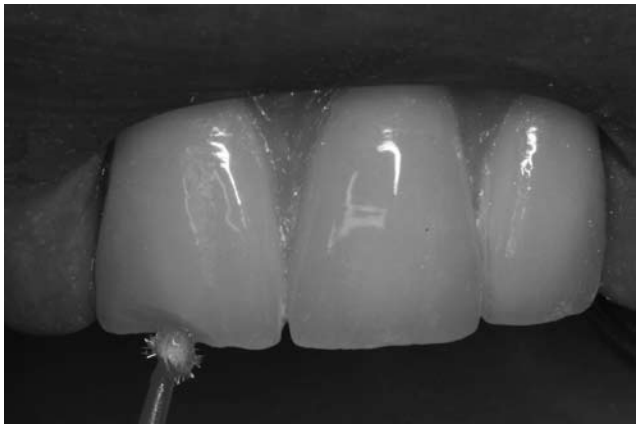

Fig. 4 – *Application of the silane agent RelyX Ceramic Primer (3M ESPE)*

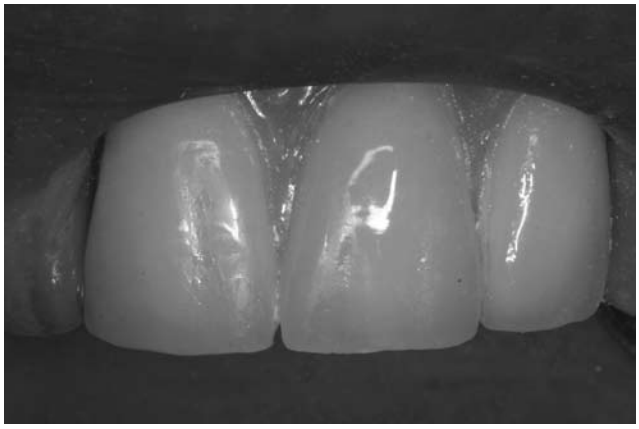

Fig. 5 – *Applied composite resin Z100.*

Fig. 6 – *Use of the Soflex (3M) disk sequence for finishing and polishing.*

3) Restoration was washed and dried

4) Applied the silane RelyX® Ceramic Primer (3M ESPE, Seefeld -Germany), allowing 60 seconds for drying (Figure 4)

5)Applied the adhesive Adper® Scotchbond® Multi Purpose (3M ESPE, St. Paul - USA), and light cured for

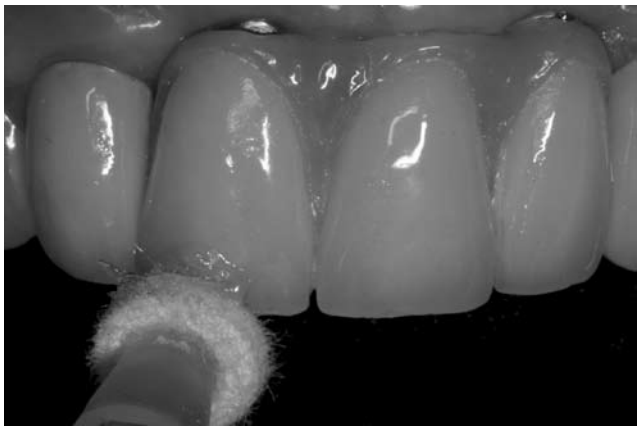

Fig. 7 – *Use of gel for polishing*

Fig. 8 – *Final view of the intraoral repair*

20 seconds

6) Applied the composite resin Z100 – Incisal Shade (3M ESPE, St. Paul - USA), incisal color, using an incremental technique (Figure 5)

The sequence of material application and photoactivation times were performed according to the manufacturer's instructions.

After one week, the patient returned to the Dental School to carry out finishing and polishing procedures on the restoration (Figures 6 and 7). The final aspect of the restoration is illustrated in Figure 8.

DISCUSSION

Metal-ceramic restoration fractures are classified as simple, when only the porcelain is involved; mixed, when the fracture involves porcelain and metal; or complex, when a large area of the metal framework is exposed. (Haselton *et al.*[8] 2001, Lotta and Barkmeies10 2000) In the presented case, the fracture involved only the porcelain.

Therefore, it was a simple fracture.

Fracture classification is important when choosing the surface treatment that will be employed in the repair, since there are treatments compatible with porcelain, others compatible with metal, and, yet, others compatible with both.

In porcelain, the most common surface treatments are hydrofluoric acid etching (Canay *et al.*[4] 2001 Thurmond *et al.*[19] 1994), airborne particle abrasion with aluminum oxide (Chung and Hawng[6] 1997, Ozcan[12] 2006) or with particles modified by silica (Bertolotti[2] 2007, Bottino *et al.*[3] 2005, Haselton *et al.*[8] 2001, Kern and Thompson[9] 1993, Martinlinna *et al.*[11] 2006, Ozcan *et al.*[15] 1998, Ozcan[16] 2006, Santos *et al.*[18] 2006,), silanization (Aida *et al.*[1] 1995), or a combination of a few of these treatments (Chen *et al.*[5] 1998 Thurmond *et al.*[19] 1994).

Hydrofluoric acid etching promotes the dissolution of the ceramic vitreous matrix, forming porosities on the treated area, and thus promoting surface roughness (Thurmond *et al.*[19] 1994). The mechanical imbrications of the repair material onto these irregularities increases the adhesive bonding. On the other hand, the hazardous effects of the hydrofluoric acid on the soft tissues is a well known fact (Chung and Hawng[6] 1997, Thurmond *et al.*[19] 1994). Hence, despite its effectiveness, hydrofluoric acid should be used sensibly to avoid harms to the oral tissue.

Airborne particle abrasion with aluminum oxide is very effective on porcelain as well as on metal, besides being a simple, inexpensive procedure. This type of treatment, as the case of hydrofluoric acid etching, promotes mechanical retention. airborne particle abrasion increases surface roughness, thus increasing the adhesive area (Chung and Hawng[6] 1997, Ozcan[12] 2006).

Silanization promotes the chemical adhesion of the restorative material to porcelain. This adhesion occurs by means of the following mechanism: silane is a bifunctional molecule; its silanol group bonds to the vitreous matrix of the porcelain, and its organofunctional group bonds to the organic matrix of the resin material employed afterward (Aida *et al.*[1] 1995). The effectiveness of the treatment with silane has been evidences in several studies (Aida *et al.*[1] 1995 Pameijer *et al.*[17] 1996).

Airborne-particle abrasion with aluminum oxide particles modified with silisic acid consist in a treatment that proposes both mechanical retention, by means of the surface roughness produced by the airborne-particle abrasion procedure, and chemical adhesion by means

of the silane applied subsequently, which bonds to the silica impregnated on the surface (Kern and Thompson[9] 1993). There are currently two systems that propose the deposition of silica by airborne-particle abrasion, the Cojet (with 30 µm particles) (Bertolotti[2] 2007, Chung and Hawng[6] 1997, Ozcan[16] 2006, Santos *et al.*[18] 2006), and the Rocatec (with 110 µm particles), both manufactured by 3M ESPE. However, the Cojet system is no longer commercialized in Brazil, and the Rocatec is used exclusively in the laboratory, which makes it difficult to employ this type of treatment for repair procedures, despite their evidenced effectiveness in porcelain (Bettino *et al.*[3] 2005, Santos *et al.*[18] 2006), and, particularly, in metal (Haselton *et al.*[8] 2001, Ozcan[12] 2006, Ozcan *et al.*[15] 1998, Santos *et al.*[18] 2006).

In this study, airborne-particle abrasion with aluminum oxide was associated with silanization to promote, respectively, mechanical retention and chemical adhesion, resulting in a satisfactory bond strength as observed in several studies (Santos *et al.*[18] 2006, Thurmond *et al.*[19] 1994). In addition, both procedures are easy to perform and do not offer any risk to the soft tissues, as hydrofluoric acid would.

Regarding the material employed in the repair, the Scotchbond Multi Use Plus (3M ESPE, Seefeld – Germany) adhesive system, there is clinical evidence of its efficacy in fractures involving only the porcelain (Chung and Hawng[6] 1997, Tulunoglu *et al.*[20] 2000), and, as mentioned before, it is a well defined protocol using products that are easily found in the dental office. In this system, the Adper® Scotchbond® Multi-Purpose (3M ESPE) adhesive, applied shortly after the silane, increases the wetting and, consequently, the contact between the opaque and the treated metal surface, which favors the micromechanical imbrications promoted by the sandblasting with aluminum oxide.

Therefore, in the present study, the choices made for repair were based on scientific evidence as well as on the feasibility and practicality of the technique. Simplicity and low-cost are great advantages of the technique presented here.

However, some limitations must be stresses, especially regarding the composite resin, such as reduced color stability and wear resistance compared to porcelain (Galiatsatos[7] 2005). Hence, it is important to perform a posterior follow up of the case with periodical reevaluations.

CONCLUSION

At the end of the procedure, both the patient and the dentist considered the result satisfactory, which shows that reestablishing the function and aesthetics of a fractured metal-ceramic restoration can be achieved in one single repair session, as long as correctly indicated and sensibly performed.

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