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Clinical case

# Rehabilitation of Patient with Biocorrosion and Attrition Using Lithium Disilicate Restorations: Case Report

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## Abstract

**Introduction:** Tooth wear is a multifactorial condition, in which three mechanisms can be classified: attrition, abrasion and biocorrosion, which compromise the dental tissues, affecting the structure and function, and the patient's quality of life. Rehabilitation of tooth wear can be achieved using adhesive techniques and ceramic materials such as lithium disilicate. **Objective:** To present the case report with non-carious lesions like biocorrosion and dental attrition, treated with indirect restoration techniques and minimally invasive techniques. **Case presentation:** A 53-year-old male patient whose reason for consultation was "*I want to fix my teeth*". Clinically generalised biocorrosion was observed; besides the abfractions and attrition, radiographically he did not present pathologies. The treatment was divided into four phases, the first focused on prophylaxis, removal of restorations and placement of provisional restorations. In the second phase, a *mock-up* test was carried out to verify the diagnostic wax-up and occlusal stability, in addition to the lengthening of crowns in the anterior sector and to make new provisionals. In the third phase, the definitive restorations made of lithium disilicate were cemented using adhesive techniques. In the fourth phase, the stability of the treatment was verified. A functional occlusion was established, along with a favourable aesthetic with good periodontal health. Conclusions. The use of restorations using adhesive techniques to manage conditions such as biocorrosion and attrition is a good alternative to preserve the tissue remnant and achieve a treatment with a favourable long-term prognosis.

**Keywords:** Bruxism, Lithium Disilicate, Adhesion, Report Case

## INTRODUCTION

The restoration of dental tissue lost due to carious and non-carious lesions has been a topic of interest in dentistry for many years. Non-carious lesions have previously been classified as abrasion, attrition and erosion. The first two are mechanical wear processes, where abrasion is produced by the interaction between teeth and other materials, and attrition by tooth-tooth contact. Although erosion is mainly caused by the demineralization of hard tissue by acidic substances[1], it is argued that the term biocorrosion is more precise because *"it is the chemical, biochemical or electrochemical action that causes the molecular degradation of essential properties in a living tissue"*[2]. It has been postulated that in a fourth wear-related process (abfraction), abnormal occlusal loading predisposes cervical enamel to mechanical and chemical wear. The loss of non-carious dental tissue is a multifactorial condition that, depending on its aetiology, can be mechanical or chemical, both intrinsic and extrinsic[3]. Although attrition and abrasion may operate together in occlusal wear, there is a consensus that interactions between erosion and mechanical wear processes are the most important[1].

Dental biocorrosion is a relatively common oral health disorder in modern society[4]. Recent evidence suggests that biocorrosive wear is common, with around 29% of young adults showing some signs of the condition[5]. Both clinical and experimental observations show that individual wear mechanisms rarely act alone, but rather interact with each other[1]. Regardless of the aetiology, dental wear is considered pathological when the loss of tooth structure is not compatible with the patient's age, requiring alternative rehabilitation treatment to restore lost dental shape and aesthetics[6].

The traditional restorative treatment for large losses of dental tissue is the fabrication of indirect restorations and onlays rather than the use of direct approaches[7], and there is a shift in restorative treatment protocols for the management of dental wear toward less invasive approaches[8]. The all-ceramic materials used for the fabrication of indirect restorations are oxide ceramics (zirconium or alumina), which require aesthetic veneering with silica-based ceramics, or lithium disilicate ceramics, which can be used in monolithic form due to their wide range of optical properties[9].

Lithium disilicate is a notable material due to its versatility of indications, which include restorations for implants, bonded partial restorations (inlays and overlays), crowns, veneers for anterior and posterior teeth, all due to its high aesthetic potential, its good mechanical properties (350-400 MPa flexural strength) and favourable bond strength to dental tissues thanks to its silica content[9,10]. Studies have shown a survival rate of 97.4% after 5 years and 94.8% after 8 years so it appears to be a reliable treatment material option[11]. Therefore, the objective is to present a case report of non-carious lesions such as biocorrosion and dental attrition, treated with indirect and minimally invasive restoration techniques.

## CLINICAL CASE PRESENTATION

A 53-year-old male patient, whose reason for consultation was "I want to fix my teeth." When performing the extraoral analysis, he presented a dolichocephalic facial biotype with a convex profile. The facial thirds were symmetrical, lips were thin, there was no dental exposure with lips at rest, and a low smile was present (Figure 1.A). In the intraoral analysis, the dental arches presented an ovoid shape, the midline deviated 1 mm to the right, a 5 mm wide keratinized gum band, the longitudinal axes in a harmonious position, passive eruption of teeth 12, 21 and 22, and little dental remnant. Loss of tooth substance was observed due to a combination of attrition and biocorrosion on the occlusal and palatal surfaces of all maxillary teeth, as well as on tooth 47, and mandibular premolars, the latter with abfractions, passive eruption on teeth 42, 41 and 31 (Figure 1.B). Orthopantomography revealed restorations in molars and root canal treatment in maxillary anterior teeth; it did not show pathologies (Figure 1.C).

The treatment objectives were established as functional occlusion in a centric relation (CR) position, obtaining adequate anterior guidance, creating restorations with adequate margins and contours to facilitate hygiene, and thus eliminating both factors that predispose periodontal disease such as cavities. Likewise, restore the gingival architecture and incisal curvature, returning adequate harmony to the smile and establish therapy with occlusal guard for exclusive night use.

Before starting, the patient was referred for consultation with a gastroenterologist to determine the causes of biocorrosion and treatment. Then, the dental treatment plan was divided into four phases: phase 1 (prophylactic) began with the removal of defective restorations and provisionalization of teeth 37 and 47. In phase 2 (pre-restorative), crown lengthening was performed in the anterior sector, mock-up testing and provisionalization of the anterior sector in accordance with the diagnostic wax-up, tooth grinding for adhesive restorations in the posterior mandibular and maxillary sector. In phase 3 (restorative), a final impression and trial of wax restorations were made for the anterior maxillary sector and lithium disilicate was processed for final cementation. In phase 4 (maintenance), the patient was reviewed after 30 days to evaluate the integration of the restorations.

It began with taking diagnostic impressions with irreversible hydrocolloid (Hydrogum, Zhermack SpA, Badia Polesine, Italy), intraoral and extraoral photographs, and a maxillomandibular


**Figure 1. Initial studies. A. Extraoral photographs of the front, profile and smile. B. Intraoral photographs, showing generalised severe wear of the occlusal surfaces, as well as non-carious cervical lesions such as abfractions. C. Orthopantomography.**

registration in CR using the Jig de Lucia deprogramming technique. Diagnostic wax-up was subsequently performed, the vertical dimension was increased to 3 mm. The mock-up test was performed with bisacrylic resin (3M™ Protemp™ 4, 3M Espe Deutschland GmbH, Germany) to verify dental exposure and anatomical contours. The defective metal-ceramic restorations on teeth 36, 37 and 47 were removed, the chamfer finishing line was reconditioned with a TR-14 truncated conical bur (Mani® Dia-Burs®, Mani Inc., Japan) and temporary self-curing acrylic (Nic Tone®, mdc® Dental, Jalisco, Mexico) crowns were placed. Once the contours were corrected, the wear was carried out in the posterior area with a bur kit for occlusal restorations (Diamanten, Jota AG, Rüthi, Switzerland), and temporary acrylic restorations were placed throughout the bimaxillary posterior sector. Afterwards, wears were made for full coverage preparations in the maxillary anterior sector, and shade A2 self-curing acrylic provisionals were placed. Due to the little remaining tooth in the antero-posterior sector, crown lengthening was performed. Once the lengthening was performed, the margin was prepared and the provisionals were adjusted.

A waiting period of six weeks was allowed to accomplish stabilization of the gingival tissues. An individual tray of self-polymerizing acrylic was made for the final impression taking. At this stage, #0 and #000 gingival retraction cord (Ultrapak™, Ultradent Products Inc., Utah, usa) moistened with haemostatic liquid were placed to realise an emergence profile in the impression (Figure 2.A). The impression was taken in 2 steps using addition silicone (3M™ Imprint II™, 3M Espe Deutschland GmbH, Germany) (Figure 2.B). Colour measurement was performed with a colorimeter (ips e.max® Ceram, Ivoclar Vivadent AG, Liechtenstein) with shade A2 (Figure 2.C).

The articulated models were cast, shaped and die-cut in a semi-adjustable articulator (Artex® CR, Amann Girrbach AG, Mäder, Austria) in which the restorations were waxed (geo Classic, Renfert GmbH, Hilzingen, Germany) which were tested in the mouth to verify contours and marginal sealing (Figure 3.A). The process of covering, dewaxing and pressing the restorations was carried out in MT lithium disilicate (ips e.max® Press, Ivoclar Vivadent AG, Liechtenstein)

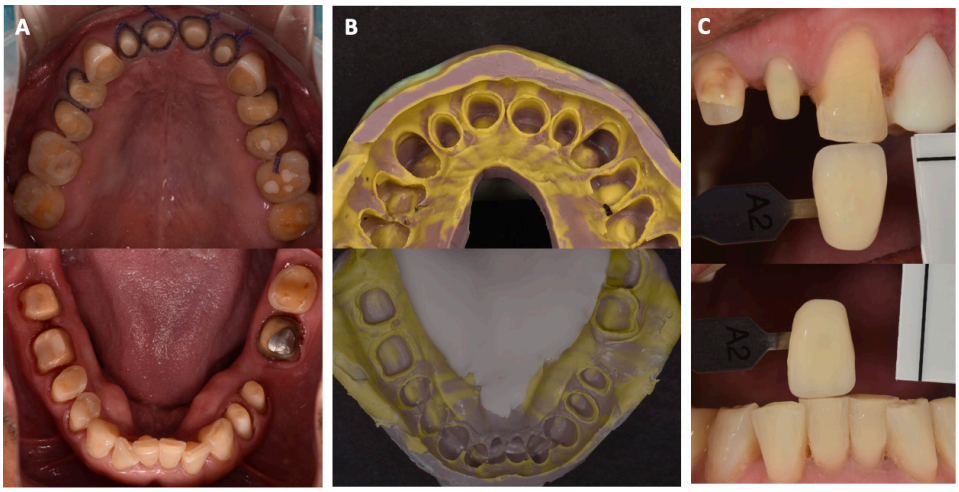


**Figure 2. Printing and color taking. A. Placement of retractor cord for impression taking. B. Final polyvinylsiloxane impressions. C. Color registration.**

shade A2 in monolithic tablet for all restorations. Once the restorations were obtained, the try-in was performed in the mouth to verify the sealing and contours (Figure 3.B).

The restorations were painted to get greater aesthetics, once the restorations were conditioned, the tooth was conditioned by sandblasting the surface with aluminium oxide at 50 microns, etching the surface with phosphoric acid (Ultra-Etch™, Ultradent Products Inc., Utah, usa) and the central, canine and lateral restorations began to be cemented using self-adhesive cement (3M™ RelyX™ U200, 3M Espe Deutschland GmbH, Germany) and photopolymerizing each restoration for 20s. Excess cement was removed and margins were polished (Figure 4.A). Impressions were taken with the new restorations and a flat guard was given to protect the restorations for exclusive use at night. Instructions were given to the patient and an appointment was made 30 days later to see the stability of the treatment.

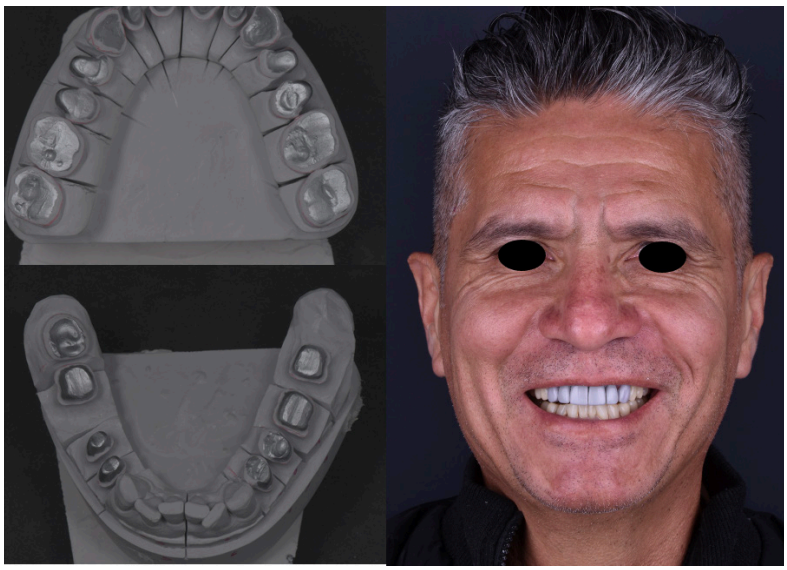

**Figure 3. Treatment progress. A. Die-cut models. B. Testing of wax restorations for evaluation of aesthetics and phonetics.**

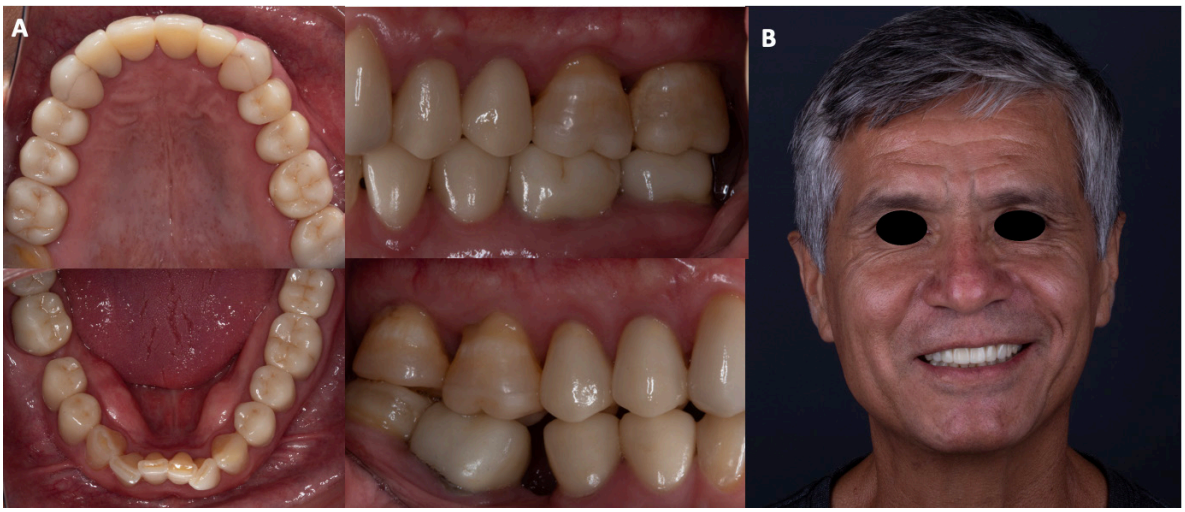


**Figure 4. Final studies. A. Intraoral photographs of the cemented restorations. B. Extraoral frontal photograph.**

As a result, the objectives set at the beginning of the treatment were met. It was possible to establish a functional occlusion, in addition to the periodontal health through contours, adequate margins and physical therapy. A harmonious smile line was obtained in the restorations for satisfactory aesthetics (Figure 4.B).

## DISCUSSION

In the present case, signs of loss of tooth substance due to attrition are shown, along with biocorrosion, which was diagnosed of intrinsic origin due to gastric acids that come into contact with the oral cavity due to gastrointestinal reflux, together with factors in the diet. In its initial stages it may be limited only to the enamel, but it can extend to the dentin as in this case, and in more advanced stages it can cause hypersensitivity and functional limitations[12].

Rehabilitation of worn dentition is common in clinical practice, usually includes philosophies or extensive treatment approaches, however, there is no solid published evidence to support the use of a specific material or technique[7]. Therefore, among the available alternatives, the one that should be chosen is the best that combines cost, benefit and longevity, which will be influenced by the correct choice of material[13]. To maximize aesthetics without compromising the strength and durability of the restorations, a conservative clinical treatment was chosen using lithium disilicate restorations, because their hardness and resistance are slightly higher compared to those made of dental enamel. It is appropriate because traditional options such as metal-ceramic and zirconia-ceramic full-coverage restorations are more susceptible to chipping or fracture of the ceramic[14]. Furthermore, these options are not consistent with the conservative treatment that was carried out in our case because they would provide complete coverage on the intact teeth.

Frattes *et al.*[15] state that adhesion is predictable in enamel and dentin when fully etched despite wear due to biocorrosion. If the patient is not treated for his gastric condition, the adhesive interface may be compromised and cause restoration failure, which is why the patient was referred to a gastroenterologist for treatment. This condition causes the rehabilitation

of biocorrosive and attrition injuries to be one of the most complex treatment procedures described in recent literature, because knowledge and skill are required on the part of the professional[4,16]. Boitelle[4] mentions that an alternative treatment consists of rehabilitation without increasing the occlusal vertical dimension, protecting the eroded surface with a composite resin filling. In these cases, the risk of failure of the reconstructions is too high, and it would only be a palliative or temporary method, so in our case ceramic restorations were chosen given the need to increase the occlusal vertical dimension, providing a considerable advantage over the resin.

The clinical performance of the teeth treated with a minimally invasive method using adhesive techniques seems promising as reported by other authors[4,14,16-18], like our case; since none of the treated teeth lost their vitality, no failure was detected in any of the restorations and overall patient satisfaction was high upon return of function and aesthetics.

## CONCLUSION

Restoration of areas with biocorrosion and attrition with minimally invasive techniques allows patients to obtain aesthetic rehabilitation and regain stomatognathic function and balance and should therefore be considered a reliable therapeutic option. The treatment decision should be based on the available scientific evidence, and the selection of materials that are appropriate in resistance and aesthetics.

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