Reverse planning for making an occlusal splint before restorative treatment: case report of rehabilitation of a patient with bruxism

Planejamento reverso para confecção de uma placa oclusal antes do tratamento restaurador: relato de caso de reabilitação de um paciente com bruxismo

Planificación inversa para la realización de una placa oclusal antes del tratamiento restaurador: reporte de caso de rehabilitación de un paciente con bruxismo

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Abstract
Recovery of worn tooth surfaces using composite resin has been increasingly accepted by clinicians, since rehabilitation through additive techniques aims at minimal or no intervention and preserves healthy dental structure, ensuring longevity to the treatment. Adhesive dentistry can afford promising results through a correct diagnosis and treatment plan. Planning can offer not only dental rehabilitation, but also controlling cause of the wear process. Strategies that seek to prevent the progression of muscle activities such as bruxism, should be

established. This article aims to present a clinical case report of a rehabilitation treatment planned and executed through the digital flow, in which the patient presents wear and tear caused by the habit of bruxism. The rehabilitation of the anterior upper teeth was carried out in direct composite resin, associated with the preparation and installation of an occlusal splint, used before, during and after the restorative treatment, ensuring the reestablishment of the shape, function and dental aesthetics.

Keywords: Temporomandibular joint disorders; Bruxism; Dental restoration wear; Composite resins.

Resumo

A recuperação de superfícies dentais desgastadas com resina composta tem sido cada vez mais aceita pelos clínicos, pois a reabilitação através de técnicas aditivas visa a mínima ou nenhuma intervenção e preservam estrutura dentária sadia, garantindo longevidade ao tratamento. A odontologia adesiva pode oferecer resultados promissores por meio de diagnóstico e plano de tratamento corretos. O planejamento pode oferecer não apenas a reabilitação dentária, mas também controlar a causa do processo de desgaste. Estratégias que busquem prevenir a progressão das atividades musculares, como o bruxismo, devem ser estabelecidas. Este artigo tem como objetivo apresentar um relato de caso clínico de um tratamento reabilitador planejado e executado através do fluxo digital, no qual o paciente apresenta desgastes ocasionados pelo hábito de bruxismo. A reabilitação dos dentes superiores anteriores foi realizada em resina composta direta, associada ao preparo e instalação de uma placa oclusal, utilizada antes, durante e após o tratamento restaurador, garantindo o restabelecimento da forma, função e estética dentária.

Palavras-chave: Distúrbios da articulação temporomandibular; Bruxismo; Desgaste de restauração dentária; Resinas compostas.

Resumen

La recuperación de superficies dentales desgastadas con resina compuesta ha sido cada vez más aceptada por los médicos, ya que la rehabilitación mediante técnicas aditivas tiene como objetivo una intervención mínima o nula y preserva la estructura dental sana, asegurando la longevidad del tratamiento. La odontología adhesiva puede ofrecer resultados prometedores a través del correcto diagnóstico y plan de tratamiento. La planificación puede ofrecer no solo rehabilitación dental, sino también controlar la causa del proceso de desgaste. Se deben establecer estrategias que busquen prevenir la progresión de las actividades musculares, como

el bruxismo. Este artículo tiene como objetivo presentar el reporte de un caso clínico de un tratamiento rehabilitador planeado y ejecutado a través del flujo digital, en el que el paciente presenta un desgaste por el hábito del bruxismo. La rehabilitación de los dientes anteriores superiores se realizó en resina compuesta directa, asociada a la preparación e instalación de una placa oclusal, utilizada antes, durante y después del tratamiento restaurador, garantizando la restauración de la forma, función y estética dental.

Palabras clave: Trastornos de la articulación temporomandibular; Bruxismo; Desgaste de restauración dental; Resinas compuestas.

1. Introduction

Masticatory muscle activities during sleep, such as bruxism, contribute significantly to the development of Temporomandibular Disorders (TMD), in addition to causing wear of the teeth and great loss of structure (Kitsoulis, et al., 2011). Therefore, the study and development of strategies for its control are important. Therapy with occlusal splint has been shown to be effective for patients with bruxism, especially in relation to tooth wear, making it a great ally of restorative treatment with composite resin (Lee, et al., 2013; Macedo, et al., 2007).

The literature indicates positive effects of occlusal splint therapy in the protect the teeth from further breakdown and position the mandible in a better place. However, the difficulty of treatment and management of worn out surfaces with resins composed by the high index of fractures of these restorations is notorious. Therefore, the previous observation of the patient's occlusion, associated with the identification of the presence of parafunctional habits can help the correct treatment planning, ensuring its longevity (Jokubauskas, et al., 2018; Negrão, et al., 2018).

Minimally invasive or noninvasive approaches have been increasingly described in the literature to recover worn surfaces and composite resin is considered by many authors to be the material of choice. Composite resin has good clinical performance, lower costs, easy execution, possibility of repair, in addition to causing less wear on the antagonist teeth when compared to ceramic (Vailati, et al., 2013; Loomans & Özcan, 2016).

In this way, restorative strategies based on digital workflow and the diagnostic wax up are more precise and faster for composite resin rehabilitation treatments (Mesko, et al., 2016). This can facilitate diagnosis and optimize communication with the laboratory, providing better anatomy to definitive restorations (Negrão, et al., 2018).

From reverse planning with intraoral scanning, it is possible to visualize and, in this

case, simulate and manipulate an occlusion splint even before the proposed restorations are made (leaving spaces for them) (Revilla-León, 2019). Therefore, this article describes a strategy for direct restoration of anterior teeth in patients with active bruxism through digital planning and waxing as well as the use of occlusal device, before, during, and after the restorative treatment.

2. Methodology

This is a clinical, descriptive, and qualitative case report, through the use of digital planning to guide the making and installation of the Occlusal Splint, as well as the Restorative Treatment in resin composite by the additive technique in a patient with dental wear resulting from the habit of bruxism. The ethical implications of the study are based on the guidelines of Resolution 466/12 of the National Health Council that regulates research in human beings. The patient signed a consent form allowing the treatment to be carried out and the photographs of the case to be published in scientific publications.

3. Case Report

3.1 Clinical Diagnosis and Digital Planning

Male patient, 28 years old, sought out the Department of Dentistry of a public higher education institution complaining about the aesthetic aspect of his anterior teeth that were worn out (Fig. 1).

Figure 1. Initial aspect of smile.

Source: Personal archives (2020).

After screening, the patient was referred to the specialized service in Stomatognathic System Dysfunction for clinical examination. In the anamnesis, it was observed that the patient had a masticatory muscle activity during sleep, defined as sleep bruxism. After occlusal analysis, it was found that the patient did not present with any change in the vertical dimension of occlusion, which made possible the reconstruction in composite resin of the worn areas on the incisal faces of the maxillary anterior teeth immediately. Rehabilitation planning was initiated with intraoral scanning as seen in Figure 2 and virtual wax up as seen in Figure 3 so the occlusal splint was drawn on this cast.

Figure 2. Intraoral scanning with overlapping planned wax up.
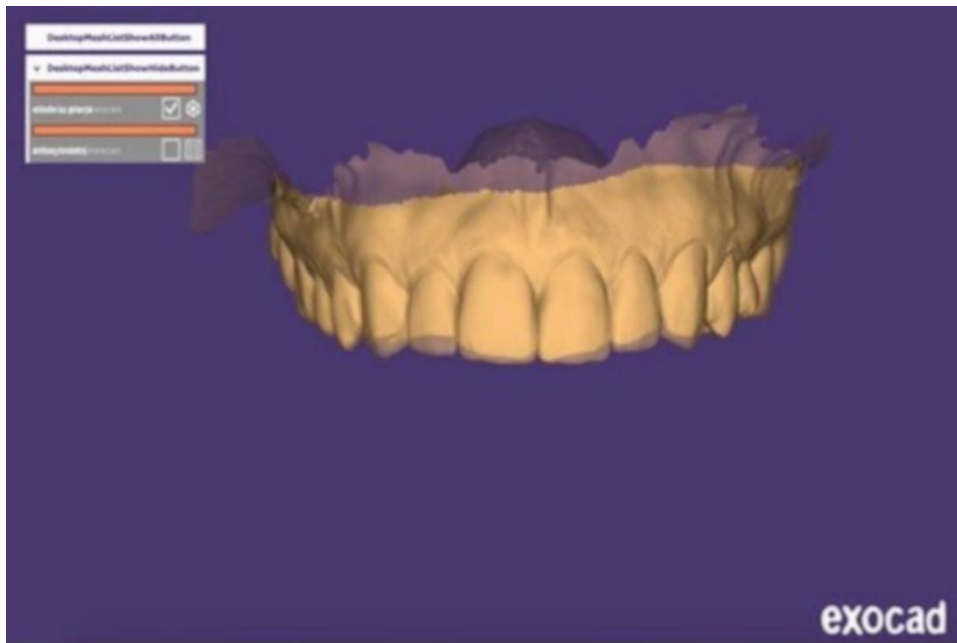
Source: Personal archives (2020).

Figure 3. Occlusal splint made from virtual cast and adapted to printed cast.

Source: Personal archives (2020).

Subsequently, using Computer-aided Design/Manufacturing (CAD/CAM) technology, the splint was milled and adapted on the cast as seen in Figure 4 to be used before, during and after the restorative treatment in order to protect the teeth and avoid fractures of the restorations. The reconstruction of worn teeth in composite resin was planned using Digital

Smile Design (DSD). The planned virtual cast was made in a tridimensional printer and, from it, a silicone palatal matrix was made to facilitate the reconstructions in composite resin (Fig. 5).

Figure 4. Device adapted to patient's arches before reconstruction with composite resin.

Source: Personal archives (2020).

Figure 5. Palatal silicone guide made on waxed and printed digital cast.

Source: Personal archives (2020).

3.2 Restorative Treatment

The patient did not choose to perform tooth whitening before the resin restorations. After color selection, the restorations of anterior teeth were made in nanofilled composite resin as seen in Figure 6, after etching with 37 % phosphoric acid and conditioning with universal adhesive. Trans 30 color effect resin was used for palatal enamel construction (Empress Direct, Ivoclar Vivadent, Schann Liechtenstein).

Figure 6. Rehabilitation of maxillary teeth with composite resin.

Source: Personal archives (2020).

For the construction of the structure referring to dentin, a A3 resin (Empress Direct, Ivoclar Vivadent, Schann Liechtenstein) was used and for construction of the opaque incisal halo, an opaque flow resin (Opak, Angelus, Londrina, Paraná, Brazil) and A1 flow resin were used. Between the dentin mamelons and the opaque halo, a color effect resin (Trans Opal, Empress Direct, Ivoclar Vivadent, Schann Liechtenstein) was used. The restoration was finished with a layer of enamel using the A2 shade resin (Empress Direct, Ivoclar Vivadent, Schann Liechtenstein). For finishing and polishing, the anatomy was initially defined using the 2135F diamond burs to make the developmental grooves and 2200F for better finishing and defining mirror areas. In the sequence, abrasive discs (Sof Lex Pop On, 3M ESPE, St. Paul, Mn, EUA) were used to define the flat area and shadow area. The polishing step was performed with the abrasive rubber burs (Astropol, Empress Direct, Ivoclar Vivadent, Schann

Liechtenstein) followed by diamond paste and felt discs. Occlusal splint was reinstalled after rehabilitation with composite resin and occlusal adjustments were performed again (Fig. 7). The patient was satisfied with the aspect of the restorations (Fig. 8).

Figure 7. Occlusal splint adjusted to arches after rehabilitation in composite resin.

Source: Personal archives (2020).

Figure 8. Definitive appearance of smile.

Source: Personal archives (2020).

4. Discussion

In the present clinical report, a good aesthetic result was achieved with direct composite resin restorations from a correct diagnosis and adequate planning using a digital workflow. This strategy is highly recommended because it is effective in preventing errors and allows the patient and the professional to preview the definitive result (Negrão, et al., 2018).

A holistic approach to dental wear for patients with bruxism includes the use of occlusal splint that is able to absorb and dissipate the stress generated and can reduce it. When the additional load caused by bruxism is not cushioned by the splint, a reaction force and consequently additional stress will be generated in the Temporomandibular Joint (TMJ), which can damage the associated joints, muscles and ligaments. Therefore, this treatment strategy creates a method of biomechanical balance between the physiological load and the generated stress, reducing this stress (Gholampour, et al., 2019).

The conventional splint is manufactured from plaster casts, based on the previous molding and after this the occlusal splints are tested and adjusted to the teeth. However, this process takes time and some factors that would influence the structural quality of the splint may occur, such as the formation of bubbles, the large amount of residual monomers and the high polymerization contraction during fabrication (Dedem & Türp, 2016).

At present, the manufacture of these occlusal devices using computerized methods and digital planning increase the possibilities of treatment and are more predictable techniques. Intraoral scanning represents a more precise and comfortable alternative for the patient. In terms of processing time, studies show that the digital technique depends on the skills of the operator, the position and region of the teeth to be faster than conventional (Berntsen, et al., 2018).

The digital manufacturing process has some advantages such as greater comfort for some patients who suffer from nausea during the conventional molding procedure, eliminating steps such as selection of the tray, manipulation of the molding material, disinfection of it, and sending it to the laboratory, and this reduces the time to make the device. Another advantage is the possibility of storage of patient data, enabling its use in the future, if there is a need for repetition. For example, if there is a breaking or excessive wear of the appliance, just request a new milling or printing, because the file with the drawing can be archived (Ender & Mehl, 2015).

The disadvantages of this type of technique are related to the higher cost when compared to the conventional technique, with the need for more sophisticated equipment and specific training for the use of these technologies. This technique can also be used in a conventional way, but generating more clinical and laboratory time than if used the digital flow (Vasques, et al., 2020).

The direct restorative strategy in composite resin from the wax up enables a more complete rehabilitation without the need for laboratory steps, as well as easy repair and satisfactory aesthetics (Negrão, et al., 2018; Gulamali, et al., 2011).

Since in this treatment, the additive digital process was performed on the maxillary anterior teeth, which are easily accessible to the scanner and in a good positioning, in this patient, the digital workflow was a great ally of the restorative planning and the more accurate manufacturing process of the occlusal splint (Salmi, et al., 2013).

Furthermore, the digital process allowed the fabrication already in the dimensions of future restorations, which made it possible to use the device even before and after the restorative procedure as well as after it (van Noort, 2011). It is also important to note that from the three-dimensional cast printing, the transfer of incisal extension became easier and faster, obeying previous digital planning, ensuring a result acceptable to the patient.

5. Final Considerations

The treatment started with a correct diagnosis and planning, associated with an adequate selection of material and technique, returning form, function, and aesthetics to the patient in a distant way. The reverse digital planning for the construction of the occlusal device allowed greater predictability in the treatment since the device was being adapted and adjusted to the patient's teeth before, during, and after the restorative treatment. After esthetic rehabilitation of the anterior teeth, the patient was very satisfied with his restored smile and continued using the occlusal splint to avoid possible fractures of the restorations due to bruxism. However, further studies are needed to prove the benefits of the digital workflow as an aid in the rehabilitative treatment of patients who have dental wear due to parafunctional habits, such as bruxism.

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