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Digital-analogue adhesive oral rehabilitation: a case report

Rehabilitación oral adhesiva digital-analógica: reporte de caso

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Resumen

Antecedentes: Los dientes desgastados son un proceso fisiológico que debe ser considerado patológico cuando afecta la función y la estética. Este desgaste es clasificado como cavidades, atrición, abrasión, abfracción y erosión. Las técnicas y tecnologías actuales llevan a los clínicos a tratamientos menos invasivos que pueden aplicarse también a sus pacientes con pérdida de estructura dental reemplazándolas con restauraciones adhesivas de diferentes materiales dentales que hoy en día pueden ser manejados digitalmente con sistemas CAD/CAM.

Descripción del caso: Paciente masculino de 78 años de edad con desgaste dental, dientes ausentes y previas restauraciones. Su caso fue estudiado para ofrecer estética, función ideal, de acuerdo a las posibilidades económicas del paciente, usando una combinación de técnicas análogo-digitales y prótesis fijas adheridas, así como también una prótesis removible.

Conclusión e implicaciones prácticas: En este reporte de caso el paciente alcanzó una estabilidad muscular y oclusal, usando diferentes materiales, cada uno seleccionado por su excelente resistencia y estética, también demostrando que técnicas análogas y digitales pueden ser combinadas con nuevas técnicas adhesivas y prótesis tradicionales removibles, demostrando al clínico que la tecnología puede ser usada en toda clase de tratamientos aunque la opción sea un plan de tratamiento más tradicional.

Palabras clave: CAD/CAM, desgaste dental, restauraciones adhesivas, prótesis fija, prótesis removible.

Abstract

Background: Worn dentition is a physiological process that must be considered as pathological when it affects aesthetics and function. This worn is classified as cavities, attrition, abrasion, abfraction and erosion. Current techniques and technologies leads practitioners to less invasive treatments that can be applied as well in this patients with loss of dental structure by replacing it with adhesive restorations of different dental materials that nowadays can be managed digitally with the CAD/CAM system.

Case description: A 78 years old male patient with worn dentition, missing tooth and previous old restorations. His case was studied for offering the ideal aesthetics, function and according to the economic possibilities of the patient, using a combination of digital-analogue techniques and adhesive fixed prostheses as well as removable prostheses.

Conclusion and Practical Implications: In this case report the patient achieved muscular and occlusal stability, using different materials, each one selected because of its excellent aesthetics and resistance, also demonstrating analogue and digital techniques can be combine with new adhesive techniques and traditional removable prostheses, showing to dental practitioner that technology can be used almost in all kind of treatments even if the choice is a more traditional plan.

Key words: CAD/CAM; worn dentition; adhesive restorations, fixed prostheses; removable prostheses.

Introduction

The etiology of tooth wear is multifactorial which means identifying one cause can be challenging. Nowadays erosion is considered as the major cause of tooth wear in almost any age, which can be related to changes in diet, social habits and oral hygiene[1].

Erosion can occur due to extrinsic or intrinsic acids, related to composition and frequency of those acids[2] The Glossary of Prosthodontics (GP) defines attrition as worn by friction, it is the loss of structure by mechanical forces and it is tooth against tooth with no other materials involved, as well GP defines abrasion as wear of a structure or substance by mechanical processes such as friction, rubbing or carving (tooth against foreign object). Abfraction is considered a Non-carious cervical lesion caused by occlusal stress and cervical enamel microfractures[3].

The new Classification of Anterior Clinical Erosion (ACE) provides a tool to identify current status of tooth of the patient and select the appropriate treatment, nevertheless it is important to understand this classification is only for maxillary anterior sector[4].

Silicate ceramic materials are considered the material of choice for replacing lost enamel coupled with minimal invasive preparations (MIP) in combination with adhesive luting. As mentioned, preservation of structure is the key part for a successful MIP[5] avoiding hypersensitivity and pulpal damage[6].

Selected materials and techniques for treatment

Partial Removable prostheses (PRP) indications are wide and varied. PRP can be indicated to overcome financial limitations, as provisional prostheses, to facilitate hygiene access, and to overcome

biomechanical and pragmatic issues associated with dental implants[7].

Fixed dental prosthesis: Uses an abutment tooth at each end of the edentulous space to bear it. If the abutment teeth are periodontal healthy, the edentulous space is short and straight, and retainers are well designed, can be expected an excellent long term prognosis[8].

Lithium disilicate: provides adequate mechanical strength and esthetics, it is considered one of the best restorative materials available today for single-unit indirect restorations[9] Adhesion to material is achieved by micromechanical interlocking and chemical bonding, reached by different treatments to the ceramic restoration[10].

Flowable injection technique: It is a quick and simple way to restore contours and shape of teeth[11].

Laboratory CAD/CAM: Computer-aided design /computer-aided manufacturing technology is a fast and easier way to manufacture dental restorations. Subtractive approach is the most current basis for CAD/CAM systems in dentistry.[12] Additive manufacturing using a 3D printer is another useful approach to create a resin pattern that is then invested and cast; those frameworks fabricated by casting 3D-printed resin patterns had demonstrated good fitting[13].

Case

A 78 years old male patient arrived to the department of Advanced Prosthodontics of the Autonomous University of Coahuila with the first concern of not liking his smile (Fig. 1 and 2). The medical history of patient was filled out and according to the American Society of Anesthesiologists (ASA) he was considered as an ASA type I.



Figure 1. Initial extraoral conditions of the patient. a.Frontal view; b.Smile view; c.Left view; d. Right view.



Figure 2. Initial conditions of the patient. a.Frontal view; b. Upper occlusal view; c. Lower occlusal view; d. Right lateral view; e. Left lateral view

Extraoral and intraoral analysis was performed according to the criteria described by Fradeani[14] An orthopantomography was requested as part of the studies prior to the treatment plan, after this maxillary and mandibular casts were taken, and the plaster casts were mounted on a semi-adjustable articulator. A diagnosis wax up was made with the occlusal scheme and desired aesthetics, it constitutes a communication tool between patient, operator and technician,[15] silicone matrices can be created from this wax-up with many purposes; this matrix can be used to show the patient the changes that may be achieved with the treatment, applying a provisional material, once accepted by the patient the same provisional gives us a guideline for tooth reduction and final restorations[16]. A prophylaxis was required prior to start with the rest of the treatment, following with the extraction of tooth 35 and total provisionalization.

Upper arch

It was determined that anterior superior sextant would receive full veneers while posterior sections would be a combination of vonlays and tabletop in order to achieved MIP.

After three weeks and acceptance from the patient, remotion of previous restorations and minimal invasive preparations of the anterior superior sextant were performed. An individual tray was manufactured and the impression was taken with polyvinylsiloxane (Imprint III, 3M Espe). Once the working model was obtained, it was sent to the laboratory to start with the flow of digital work (Fig. 3), the laboratory was asked to respect the length established in the analog waxing, once the design of the restorations had been reviewed and authorized, the laboratory was able to continue with the milling of the same, for this procedure the milling machine was CORiTEC 250i by imes-icore and e-MaxCAD MT A2 blocks

were used. Restorations were tried then in the patient. After verification of restorations fit, the protocol of adhesion was performed; Tooth structure were polished with pumice, different materials were needed, and they are mentioned, also their used is described as follows; translucent dual resin cement (RelyX Ultimate, 3M Espe), hydrofluoric acid (IPS Ceramic Etching Gel, Ivoclar Vivadent) 9% for 20 seconds. Etched surfaces were rinsed and cleaned with phosphoric acid 35% for 10 seconds, followed by ultrasonic bath in alcohol for 5 minutes. The Veneers were once again rinsed and air dried. An agent of silane coupling (Silane, Ultradent) for 1 minute and air dried. The surface was coated with adhesive (universal single bond, 3M), diluted with air for evaporation of the solvent and left without photocuring. Dental preparations were etched with 35% phosphoric acid for 20 seconds, were washed and air dried, then the universal single bond adhesive, ceramic restorations were loaded with the light-curing resin cement and were placed on the teeth. All excess cement resin was carefully removed before light curing. Each surface is light cured for 40 seconds. A water soluble glycerin gel was used to block air, and the restoration margin was cured again for 40 seconds per surface. Excess resin cement was removed with a scalpel. They adhered one by one for better control of the bonding and cleaning process, starting with the central incisors and ending with the canines. Adhesive protocols can vary in order to different materials. Once the restorations were cemented, the maxillary posterior tooth were treated following the same steps previous described with each type of adhesive restoration in particular.

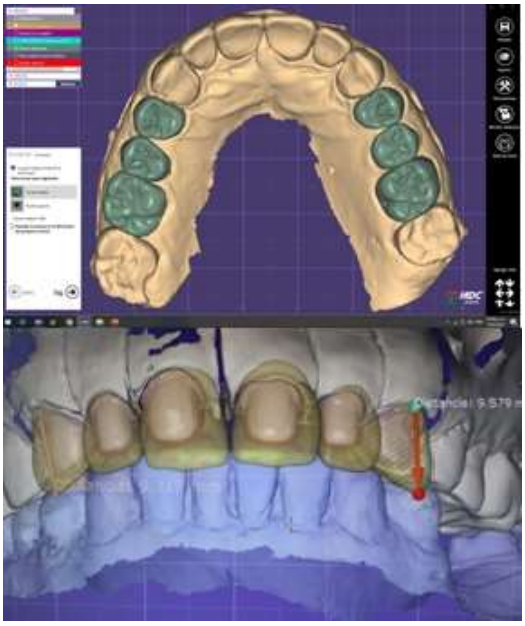


Figure 3. Digital work flow for definitive restorations.

Lower Arch

A STL file obtained digitally was used, first taken with polyvinylsiloxane, laboratory made a digital wax-up and once authorized the model was printed and a mockup was tested in patients, mouth and once he accepted, we proceed to make the injected resins in the lower anterior section with the stablished protocol.

Tooth 35, 36, 44 and 47 were prepared for complete metal ceramic crowns design for support PPR; and 37 were prepared for table top using the same instruments and materials for the upper arch.

For the design of PPR a polyvinylsiloxane impression was taken, and once the working model is obtained, it is sent to the laboratory for the elaboration of the 3D design and printing in castable resin for then continue as an analog laboratory procedure (Fig. 4).



Figure 4. Digital design for PRP.



Figure 5. Smile; a. Initial smile; b. Final smile.



Figure 6. Final conditions of the patient. a. Frontal view; b. Upper occlusal view; c. Lower occlusal view; d. Right lateral view; e. Left lateral view

Discussion

In the last years dental practitioners have been paying special attention to conservation of tissue and its biomechanics to avoid pulpal damage, making a tooth more fragile and as a result not giving it the most long term prognosis of function.[17] An alternative for restorations is the CAD/CAM system which can be used for ceramics and resin blocks as well, nevertheless, tooth preparations for adhesive restorations relies in the same principles no matter if it's a digital, analogue, or combine protocol, but they are different from the principles for cast-gold restorations which were more invasive[18].

Gresting & cols. Determine in a study comparing composite restorations and ceramic ones that in a period of 3 years that ceramic and composite restorations have similar survival rates[19], nevertheless in a follow up of 10 years of the same study the

author concluded that ceramic has better survival rate than composite in terms of fracture, surface roughness, color match and wear of restoration[20].

In this case and based on searched evidence, a particular diagnosis was performed for each tooth and that gave the guideline for every decision of treatment and material, that is the reason a combination of materials and techniques were selected.

Conclusion

The new materials and techniques give the dentist the advantage of being able to provide complete rehabilitation treatments without the need to be invasive, removing healthy dental tissue, in the same way with CAD/CAM technology, working time can be optimized, having in the advantage of being able to make use of technology and materials to provide an aesthetic and functional treatment, appropriate to the possibilities of the patient and with a treatment that combines the conventional, such as the removable prosthesis in this case, with the new adhesive and design techniques of computer restorations.

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