CASE REPORT

ANTERIOR REHABILITATION WITH CAD/CAM SYSTEM: CASE REPORT

CASO CLÍNICO: REABILITAÇÃO CERÂMICA ANTERIOR COM SISTEMA CAD/CAM

Amanda Palumbo Franco[1], Nathália Lima Freze Fernandes[2], Loana Paula de Oliveira[3]

Resumo

Devido a constante busca por um sorriso harmônico, o nível de exigência e a expectativa dos pacientes tornam-se elevados, propiciando o desenvolvimento de novos materiais e técnicas odontológicas que visam procedimentos mais conservadores e resultados cada vez mais previsíveis esteticamente. As técnicas com Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) têm ocupado lugar de destaque na Odontologia. Isso se deve ao fato de que o projeto auxiliado por computador ou fabricação assistida por computador oferece um método de restauração que diminui o risco de erro humano e fornece resultados altamente estéticos em um tempo clínico reduzido, embora com custos relativamente altos. O objetivo do presente estudo é apresentar, através de um relato de caso clínico, uma reabilitação estética por meio da aplicação prática do sistema CAD / CAM. Com a finalização do caso foi possível observar melhora estética através da confecção das coroas cerâmicas anteriores e melhora da condição oclusal com a confecção de prótese removível superior, a qual viabiliza uma maior durabilidade das coroas cerâmicas, pois distribui melhor as cargas oclusais entre os elementos, evitando cargas excessivas no local das novas restaurações indiretas. Este relato de caso foi realizado em duas sessões odontológicas alcançando satisfação estética da paciente. Possui um acompanhamento de curto prazo, portanto, são necessários casos com acompanhamento a longo prazo para comprovar o sucesso dessa técnica. Pode-se considerar uma limitação o elevado custo tecnológico, porém é notório avanço na odontologia para melhorar a qualidade no tratamento em períodos extremamente curtos.

Palavras-chave: CAD-CAM. Prótese Dentária. Reabilitação. Prótese Parcial Fixa.

Abstract

Due to the constant search for a harmonic smile, the level of demand and the expectations of patients become high, enabling the development of new materials and dental techniques that aim at more conservative procedures and more and more predictable results aesthetically. Techniques with Computer Aided Design and Computer Aided Manufacturing (CAD / CAM) have occupied a prominent place in Dentistry. This is due to the fact that computer aided design or computer aided manufacturing offers a restoration method that lowers the risk of human error and provides highly aesthetic results in a reduced clinical time, albeit at relatively high costs. The objective of the present study is to present, through a clinical case report, an aesthetic rehabilitation through the practical application of the CAD / CAM system. With the completion of the case, it was possible to observe aesthetic improvement through the preparation of the anterior ceramic crowns and improvement of the occlusal condition with the manufacture of a removable upper prosthesis, which enables greater durability of the ceramic crowns, as it better distributes the occlusal loads among the elements, avoiding excessive loads at the site of new indirect restorations. This case report was carried out in two dental sessions, achieving patient aesthetic satisfaction. It has a short-term follow-up, therefore, cases with long-term follow-up are necessary to prove the success of this technique. The high technological cost can be considered a limitation, but there is a notable advance in Dentistry to improve the quality of treatment in extremely short periods.

Keywords: *CAD-CAM. Dental Prosthesis. Rehabilitation. Denture, Partial, Fixed.*

1. Department of Restorative Dentistry, Naval Dental Center (Odontoclínica Central da Marinha), Brazilian Navy, Rio de Janeiro, Brazil.
2. Semiology Service, Naval Dental Center (Odontoclínica Central da Marinha), Brazilian Navy, Rio de Janeiro, Brazil.
3. Clinic of Geriatric Dentistry, Naval Dental Center (Odontoclínica Central da Marinha), Brazilian Navy, Rio de Janeiro, Brazil.

How to cite this article:
Franco AP, Fernandes NLF, Oliveira LP. Anterior rehabilitation with CAD/CAM system: Case report. Nav Dent J. 2020; 47(2): . 43-50.

Received: 03/08/2020
Accepeted: 22/09/2020

INTRODUCTION

The current concept of restorative dentistry recommends that, for any type of oral rehabilitation, the professional should always opt for more conservative procedures, avoiding unnecessary wear on the dental structure. It is necessary to consider that, in many cases, indirect restorations require wear, but these, when planned and controlled, can be much more conservative and effective when considering aesthetics and longevity (1).

The constant search for a harmonic smile raises the level of demand and expectations of patients. This fact promotes the development of new dental materials and techniques that aim at more conservative procedures and results that are increasingly more aesthetically predictable (2). Among the various treatment options for aesthetic purposes, techniques with Computer Aided Design and Computer Aided Manufacturing (CAD / CAM) have occupied a prominent place in Dentistry. This is due to the fact that the Computer Aided Design or Computer Aided Manufacturing (CAD / CAM) offers a restoration method that lowers the risk of human error and provides highly aesthetic results in a reduced clinical time, albeit with relatively high costs (3).

The CAD / CAM system was first introduced in dentistry in the 1980s (4,5). This technology has aroused growing interest for both dentists and manufacturers, as the development of hardware and software has improved the accuracy, ease of use and clinical performance of restorations (6,7). The CAD / CAM system aims to produce a prosthetic restoration in a single consultation, with the entire manufacturing process performed within the dental office (8). Continuous improvements in this system have led to a wider acceptance in dental practice (7).

Among the advantages of these machines, the quality of the data derived from digitization can be highlighted, a combination of veracity and precision (9,10).

The objective of the present study is to present, through a clinical case report, an aesthetic rehabilitation through the practical application of the CAD / CAM system.

CASE REPORT

Patient N.B, 63 years old, female, showed up at the Brazilian Naval Dental Center (Odontoclínica Central da Marinha,OCM) dissatisfied with the aesthetics of her smile, highlighting the chromatic difference between the upper anterior elements. The patient signed the informed consent form and agreed with the research and dissemination of the clinical case. First, anamnesis was performed, followed by clinical and radiographic examinations. Thus, the presence of provisional crowns, in acrylic resin, was found to be pigmented, unsuitable and unsatisfactory aesthetically. It also had a composite resin restoration with vestibular mismatch on the upper left canine (tooth 11) and the presence of disproportionate gingival margins between the elements.

Initial photographs (Figures 1, 2 and 3) were taken to assist in the planning and execution of the treatment. After planning and interacting between dentists, patient and technician, it was decided to perform the preparation of the dental element and make the crown in pure ceramic ("metal free") with CEREC system in the upper incisors (teeth 7,8,9,10) and restoration in composite resin on tooth 11.

Figure 1 - initial face photo

Figure 2 - smile photo

Figure 3 - intraoral photo

The provisional crowns were removed and due to the little coronary remnant, the need to make an intra-root retainer was observed in all elements that would receive the ceramic crowns; the endodontic treatment of the elements was satisfactory and were maintained for rehabilitation.

To make the intra-radicular retainers (upper incisors) the work field was isolated, the gutta percha was removed from the conduits, with gates drill no. 2, in a proportion of two thirds, thus proceeding the selection the Whitepost Dc® fiberglass pin (FGM, Joinville, Santa Catarina, Brazil) with a diameter compatible with the light of the root canal of each incisor. The root canal was cleaned with sodium hypochlorite, washed with abundant water and removed moisture with absorbent paper cones.

The fiberglass pin was prepared according to the manufacturer's instructions, by cleaning the pin with 70% alcohol, applying Prosil silane (FGM) over the surface of the entire pin for 60 seconds and then drying it. With the aid of a Centrix needle application tip, the self-adhesive resin cement with dual polymerization RelyX ™ U200 (3M-Espe) was taken inside the duct, the pin was carefully inserted into the channel and the light cured of the cement through the pin. using the Valo ™ Cordless Curing Light in Standard power mode (1000 mW / cm^2). After this stage, the dental remnant was conditioned with 37% phosphoric acid for 15 seconds, followed by washing and drying. Adper ™ Single Bond 2 (3M Espe) adhesive was applied to the dental surface with the aid of a disposable KGbrush® applicator (KG Sorensen, São Paulo, Brazil) and photopolymerized for 20s on each tooth. A filling core was made with composite resin Filtek ™ Z250 (3M-Espe) using the incremental technique and photopolymerization of 20 seconds per increment.

The wear of the light-curing resin filling core was carried out with a 2135 conical stem diamond tip (KG Sorensen), respecting the inclination of the cervical, middle and incisal thirds of the dental elements. The interproximal areas were also prepared with the same diamond tip. The preparation of the elements was carried out in order to allow an adequate seating and resistance of the prosthetic part. In a subsequent session, the A3 color was selected based on the VITA color scale (Vitapan, Vita Zahnfabrik, Bad Säckingen, Germany).

Aiming at an efficient scanning of the prosthetic preparations and correct delimitation of the endings, gingival spacing was performed by mechanical technique with double retracting wire, using ultrafine (000) and extrafine (00) Pro Retract (FGM) wire. The fingerprints of the maxilla, mandible and the record of the oral bite at maximum habitual intercuspation, were recorded through an intraoral camera (Cerec Omnicam, Sirona Dental Systems, Bensheim, Germany). After obtaining the 3D virtual models, the special software (inLab SW 4.2.1.61068, Sirona Dental Systems, Bensheim, Germany) was used to design the dental elements. The options "Biogeneric Individual" and "Bridge Restoration" were selected for the design mode and type of restoration, respectively. The ends of the preparation margins were delimited in the virtual model and then an anatomy proposal for restoration was calculated by the software; some modifications were made to this project in order to improve the final aesthetic. All scanning procedures were performed according to the manufacturer's guidelines and performed by the

same operator. The complete CAD data was sent electronically to the machining center in the ontological clinic laboratory (CAM); which used the feldspar ceramic blocks from Vita (Sirona), (Figure 4)

Figure 4 - Cerec System 4.4

After finishing machining, the prosthetic parts were polished with Edenta's low abrasion rubbers and Becth's goatskin disc, then they were subjected to the following steps: conditioning with 10% hydrofluoric acid for 60 seconds, washing with water for 30 seconds, air blast drying, application of Silano Prosil (FGM), drying, application of a thin layer of Adper ™ Single Bond 2 (3M-Espe) adhesive inside the part, application of a light air jet and light curing for 10 seconds. The preparation of the dental element for cementation consisted of cleaning the preparations with pumice and water, washing and removing excess moisture. The cement chosen was the self-adhesive resin cement RelyX ™ U200 (3M-Espe). After being handled, the cement was taken inside the prosthetic part that was seated in the preparation. The excess cement was removed and the element was photoactivated for 60 seconds on each side, using the Valo ™ Cordless Curing Light in Standard power mode (1000 mW / cm^2).

With the completion of the case, it was possible to observe aesthetic improvement through the making of the anterior ceramic crowns and improvement of the occlusal condition with the making of an upper removable prosthesis; which enables a greater maintenance of the ceramic crowns, avoiding excessive loads and better distributed among the elements. (Figures 5,6,7)

Figure 5 - Final face photo

Figure 6 - Final smile photo

Figure 7 - Final intraoral photo

DISCUSSION

The development of digital work in dentistry has increased in recent years due to the progress made in technologies such as intraoral scanners and software programs, which have contributed to improving the efficiency of rehabilitation and reducing the time of clinical work (11).

Due to the introduction of a whole range of devices, machines and software, the digital revolution is completely changing the profession of the dental surgeon. In this way, we can plan surgical and restorative procedures in detail with the help of 3D molding and CAD/CAM software (12). Intraoral scanners are digital devices used not only to obtain study models, but also to model restorations (13). Fingerprints also contribute to a more accurate record of the bite, and help to eliminate various analog procedures that can generate distortions (14).

These computerized systems can make crowns, fixed bridges in addition to implant connections. Among the materials used, dental ceramics are the highlight, as they are increasingly being requested in dental clinics. Its clinical application has established itself for presenting several desirable properties, similar to natural teeth, among which stand out: translucency, fluorescence, chemical stability, coefficient of linear thermal expansion close to that of tooth structure, biological compatibility, as well as greater resistance to compression and abrasion (13). Clinical studies have shown good results in the aesthetic area, due to biocompatibility, marginal adaptation and good relationship with periodontal tissues, resulting in longevity for restorative treatment (13,14).

Various ceramic materials and new techniques have been developed during the last decades, since the properties of traditional ceramic materials had limited indication for restorations of greater extensions due to excessive forces (14). The addition of oxides was intended to further improve the strength of ceramics, where the incorporation of zirconia, resulted in a significant increase in flexural strength, giving one of the highest tenacity values among ceramic materials, however it led to a highly opaque, as in the In Ceram Zirconia system, which presents a mixture of approximately 69% alumina oxide (Al_2O_3) with 31% zirconium oxide (ZrO_2) (15, 17). Its more precise indications were therefore limited to regions posterior, both for single crowns and for fixed prostheses of three elements (15). However, feldspar ceramics are indicated for restorations made entirely of ceramics with a low leucite content (16). They are indicated for making single crowns, inlays, onlays and laminated veneers; its low resistance limited its indication only for anterior unit crowns in situations of low occlusal stress (17). Thus, in the present case, due to the need for esthetic restoration and favorable occlusion, feldspar ceramic was selected for making the crowns.

Feldspathic ceramics have feldspar as the main component (60% of the composition) and are obtained from kaolin (clay) and quartz. These consist of a glassy (amorphous) matrix, the main constituents of which are 60% silicon dioxide; aluminum oxide; sodium oxide and potassium oxide. Most porcelains have crystalline particles dispersed in this matrix, such as leucite, alumina or fluorapatite. However, some of them do not have a crystalline phase, constituting only the vitreous phase (18). Feldspathic porcelains have translucency and a linear thermal expansion coefficient similar to teeth; they are resistant to compression and hydrolytic degradation promoted by oral fluids, in addition to having no corrosive potential. The patient had pigmentation in the gums originating from her former indirect restorations. In this way, the selection of this material will avoid new stains and be resistant to environmental degradation, bringing longevity of the treatment.

The double wire technique was used in the clinical case presented, which is indicated when it is desired to make moldings of one or multiple pillars. This technique requires additional time to insert the second wire, and although gingival clearance has the potential to cause greater gingival trauma, it is used with great success (19). This technique is beneficial when the termination line is sufficiently below the gingival margin and two strands can be inserted into the groove. It is also effective when the soft tissue covers the first thread and does not keep the tissue away laterally (19). The technique consists of a small diameter wire pre-soaked with hemostatic medication (in this case the Hemostank of Biodynamics was used) and positioned at the base of the gingival sulcus to prevent bleeding. The line at the end of the preparation becomes more visible after the small wire is placed in the groove. The second large diameter thread is also impregnated with hemostat and placed

in the groove above the first thread. Thus, the preparation ends were well exposed for the correct scanning and making of the ceramic crown.

The cementation phase of ceramic crowns requires an excellent cement to be clinically successful. The development of cementing agents was essential to obtain a long duration, retention of indirect restorations and nuclei in the oral cavity. To perform this step, it is necessary to treat the surfaces of the dental substrate and the surface of the restoration, which will depend on the characteristics of the ceramic system added to the peculiarities of the cementing agent, in order to guarantee the clinical success of this rehabilitation procedure (20). Ceramics have the ability to reproduce the complex optical phenomena observed in the dental structure, such as fluorescence, opalescence, translucency and opacity, which makes them considered excellent when compared to other aesthetic materials (16). In addition to these characteristics already mentioned, the characteristics related to color and texture can also be highlighted as advantages of dental ceramics, promoting superior aesthetics; the mechanical resistance that allows color stability, high resistance and durability, low accumulation of biofilm due to its excellent surface smoothness, the coefficient of thermal expansion close to that of the tooth and the stiffness compatible with the remaining tooth (21).

Self-adhesive resin cements do not require pretreatment on dentin (acid etching and application of adhesive), as they combine the use of the adhesive system with resin cement in a single application (22, 23). The simplification of the cementation protocol through the use of self-adhesive cements aims to eliminate critical stages of the adhesion process, such as the application of phosphoric acid, washing with water, drying and application of the adhesive system, and also allows the reduction of the time of application. service (24.25). Self-adhesive cements are believed to be moisture tolerant, release fluoride and have no postoperative sensitivity. These advantages have attracted great interest from manufacturers and clinicians, as they combine simplification and less technical sensitivity (26). Therefore, in the present study, dual self-adhesive resin cement RelyX ™ U200 was used.

In relation to the manufacture of permanent restorations, Cerec CAD / CAM machines are currently used to manufacture ceramic restorations based on computer-aided design and produce them in a single dental appointment (10). These restorations, commonly made with ceramic material, are becoming increasingly popular around the world. Recently, CAD/CAM systems, especially digital printing systems, have resulted in improved restoration processes, providing an aesthetic improvement in "metal free" restorations, providing more natural and harmonic shapes (27).

The Cerec system (Sirona Dental®, Bensheim, Germany) uses the preparation of the preparation image directly in the oral cavity by the dentist, with the aid of a micro-camera. The captured image is then processed by the unit (CAD) so that the restoration can be planned and performed, aided by the computer (CAM). Optical reading is performed over the entire length of the preparation, and the entire preparation area is visible through the micro-camera. The Cerec system milling procedure is performed using a diamond tip and a wear disc (Cerec® 2, Sirona Dental®) or two diamond tips in a modular unit (Cerec® 3, Sirona Dental®). After the adjustment and initial polishing steps, restorations can be characterized with pigments and application of glaze. The ceramic materials used for this system can be Vita MK II® Blocks (Vita®), Vitablocks® (Vita®), Ivoclar ProCad® (Ivoclar / Vivadent AG®), Vita MK II Esthetic Line® (Vita®) and Dicor MGC ® (Dentisply®) (28.29).

The digital working time provided better control of the desired results and also improved communication between all three parts consisting of the dentist, patient and laboratory. It is important to highlight the basic principles for patient rehabilitation using CAD / CAM technologies and to continue using the same principles used in "split cast" systems. With fingerprints, some of the steps that lead to failures can be eliminated, such as the contraction of the material, providing better predictability of the results, high precision in the adjustment of the ceramic crowns in addition to rapid execution (30).

CONCLUSION

This case report was carried out in two dental sessions, and patient's aesthetic satisfaction was achieved. It has a short-term follow-up. More cases with long-term follow-up are needed to confirm the success of this technique. Although the high technological cost could be considered a limitation, there is a notable advance in Dentistry to improve the quality of treatment in extremely short periods.

The authors declare no conflicts of interest

Corresponding author: Loana Paula de Oliveira. Odontoclínica Central da Marinha, Praça Barão de Ladário, 1 - Centro, Rio de Janeiro - RJ, 20091-000
E-mail: loanapauladeoliveira@gmail.com

REFERENCES

1. Belser UC, Magne P, Magne M. Ceramic laminate veneers: continuous evolution of indications. J Esthet Dent. 1997; 9(7): 197- 207.
2. Goldstein RE. Study of need for esthetic in dentistry. J ProsthetDent.1969;21 (7):589-98.
3. Santos Jr GC, Santos MJ., Rizkalla AS, Madani DA.El- Mowafy,"Over view of CEREC CAD/CAM chairside system . General Dentistry. 2013; 61 (4):36–40.
4. Crawford R. Computers in dentistry. Part one. CAD/CAM: The computer moves chairside. J Can Dent Assoc 1988;54: 661-663.
5. Mormann WH, Brandestini M, Lutz F, Barbakow F. Chairside computeraided direct ceramic inlays. Quintessence Int 1989;20:329-339
6. Stutes RD. The history and clinical application of a chairside CAD/CAM dental restoration system. Shanghai J Stomatol 2006;15:449-455.
7. Bernhart J, Schulze D, Wrbas KT. Evaluation of the clinical success of Cerec 3D inlays. Int J Comput Dent 2009;12:265-277.
8. Miyazaki T, Hotta Y. CAD/CAM systems available for the fabrication of crown and bridge restorations. Aust Dent J. 2011;5(1):97-106.
9. Ender A, Mehl A. Accuracy of complete-arch dental impressions: a new method of measuring trueness and precision. J Prosthet Dent. 2013;109(8):121–128.
10. Aragón ML, Pontes L, Bichara L, Flores-Mir C, Normando D. Validity and reliability of intraoral scanners compared to conventional gypsum models measurements: a systematic review. Eur J Orthod. 2016;38(9):429–434
11. Coachman C, Van Dooren E, Gürel G, Landsberg CJ, Calamita MA, Bichacho N. Smile Design: From digital treatment planning to clinical reality. In: Cohen M, editor. Interdisciplinary Treatment Planning. Comprehensive Case Studies. Quintessence. 2012; 2(2):119–174.
12. Tarantili VV, Halazonetis DJ, Spyropou-Los MN. The spontaneous smile in dynamic motion. Am J Orthod Dentofac Orthop. 2005;128(7):8–15.
13. Garcia, FRL; Simonides, CP; Costa, CF; Spuza, CPF. Análise crítica do histórico e desenvolvimento das cerâmicas odontológicas. RGO - Rev Gaúcha Odontol.2011; 59(6):67-73.
14. Aguiar, MGE. Sistemas cerâmicos na reabilitação oral: relato de caso clínico. Rev Odontol Bras Central.2016; 72 (6) :25-31.
15. Schmitt J, Wichmann M, Karl M, Göllner M, Lohbauer U, Holst S. Surface characteristics of zirconia-based posterior restorations: clinical and scanning electron microscopic analysis. J Can Dent Assoc. 2011; 77(3):31-34.
16. Touati B, Miara P, Nathanson D. Odontologia estética e restaurações cerâmicas.2000.
17. Amoroso, P. A. et al. Cerâmicas odontológicas: propriedades, indicações e considerações clínicas. Revista Odontológica de Araçatuba.2012; 33(6):19-25.
18. Neis, C. A. et al. Surface treatments for repair of feldspathic, leucite - and lithium disilicate-reinforced glass ceramics using composite resin. Braz Dent J. 2015; 26(3):152-155.
19. Baba, N. Z. et al. Gingival displacement for impression making in fixed prosthodontics: contemporary principles, materials, and techniques. Dental Clinic North American, Philadelphia.2014; 58(7):45-68.
20. Amaral, M et al. The potential of novel primers and universal adhesives to bond to zirconia. J Dent.2014; 42(8):90-98.
21. Mazaro, J. V. Q. et al. Cerâmicas monolíticas: mito, realidade ou apenas mais uma opção clínica? Associação Brasileira de Odontologia. Pro-odonto Prótese e dentística.2016; 4(10):9-42.
22. Viotti RG, KasazA, PenaCE, Alexandre RS, ArraisCA, ReisAF. Microtensile bond strength of new self-adhesive luting agents and conventional multistep systems. J Prosthet Dent. 2009;102(5):306-12.
23. Ferreira RS, Andreiuolo RF, Mota CS, Dias KRHC, Miranda MS. Cimentação adesiva de pinos fibrorreforçados. Rev Bras Odontol. 2012;69(2):194-8.
24. Weiser F, Behr M. Self-adhesive resin cements: a clinical review. J Prosthodont. 2015;24(2):100-8.
25. D'Arcangelo C, D'Amario M, Vadini M, De Angelis F, Caputi S. Influence of surface treatments on the flexural properties of fiber posts. J Endod. 2007;33(7):864-7.
26. Radovic I, Monticelli F, GoracciC, Vulicevic ZR, Ferrari M. Self-adhesive resin cements: a literature review.J Adhes Dent. 2008;10(4):251- 8.

27. Roperto R, Assaf H, Soares-Porto T, Lang L, Teich S. Are different generations of CAD/CAM milling machines capable to produce restorations with similar quality? J Clin Exp Dent. 2016;8:423–8.
28. Lund PS, Campbell SD, Giordano R. Optical evaluation of the translucency of core and venner materials. J Dent Res. 1996;75(3):284-287.
29. Nagai SI. Optical evaluation of the translucency of In-Ceram core material. J Dent Res. 1996;75(4):248-252.
30. L. Infante, B. Yilmaz, E. McGlumphy, and I. Finger, "Fabricating complete dentures with CAD/CAM technology," Journal of Prosthetic Dentistry.2014; 111(5):351–355.