Case Report

Open Access Journal of
Biomedical Science
ISSN: 2690-487X

Aesthetic Restorations in Anterior Teeth Using CAD/CAM Technology: Case Report

Delal Bozyel*, Simge Taşar and Aynil Keskin

Department of Prosthodontics, Near East University, Cyprus

ABSTRACT

Aesthetic rehabilitations hold a great place in prosthetic dentistry. The materials chosen and the techniques used during the treatment procedure are as important as the importance given to the appearance. Together with the developing technology, the restorations produced with the CAD/CAM systems provide a great convenience for both the patients and the dentist. In this case report, the provision of new crowns manufactured by using CAD/CAM system in the anterior region to replace the old composite restorations is presented. Within this case, it was planned to fabricate crowns by using feldspathic ceramics. The final restorations have shown satisfactory results in terms of aesthetics and function.

KEYWORDS: Aesthetics; Prosthetic dentistry; CAD/CAM system

INTRODUCTION

In modern society, dental health has started to be considered not only as functional; but also, as an important factor in terms of aesthetics. In recent years, the subject of aesthetics has become increasingly important and patients' expectations about aesthetic dentistry have increased. However, meeting the aesthetic expectations of patients requires more than paying attention only to the appearance. Material selection, preparation, cementation, and production techniques are the main factors in the longevity of aesthetic dental restorations. In the meantime, professional oral care and the patient's knowledge of oral hygiene are equally important [1].

Metal-supported ceramic systems have proven their success in crown and bridge restorations [2]. However, insufficiency in biocompatibility and optical properties of metal-supported ceramics [3,4] lead to the emergence of dental ceramics, while the rapid increase in aesthetic expectations has made dental ceramics a highly preferred material in dentistry. Restorations produced with CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) technology from ceramic blocks, which are prepared as fabrication and reinforced with the developing technology, are also becoming increasingly common applications in dentistry practice. The dental CAD/CAM system consists of a scanner, a software to process the scanned data and a manufacturing system that converts the data into actual restorations, dentures, or appliances. This "digital workflow" records both dentitions, allowing clinicians to review and assess tooth preparation and design restorations that meet the expected treatment plan. Before proceeding to the next step, it is possible to adjust if needed, as the digital files can be uploaded to the cloud server for quick communication with the technicians. The technique is usually time effective and eliminates the requirement of impression materials, and in most of the cases, enables the conveyance of the outcome in one and the same appointment [5]. In this article, it is aimed to present a CAD/CAM anterior aesthetic case event using a full ceramic restoration.

CASE REPORT

The 25-year-old man patient applied to the Near East University, Faculty of Dentistry, Department of Prosthodontics

Quick Response Code:

Address for correspondence: Delal Bozyel, Near East University, Faculty of Dentistry, Department of Prosthodontics, Nicosia, Turkish Republic of Northern Cyprus

Received: April 21, 2021 **Published:** May 04, 2021

How to cite this article: Delal B, Simge T, Aynil K. Aesthetic Restorations in Anterior Teeth Using CAD/CAM Technology: Case Report. 2021- 3(6) OAJBS.ID.000274. **DOI:** 10.38125/OAJBS.000274

as he was uncomfortable with the appearance of old composite restorations in teeth 11 and 21 (Figure 1). The patient request was to get rid of the tonal differences of composite restorations in his mouth that were made at different times and to have restorations that he could use for a long time without changing color. According to the anamnesis taken from the patient, it was informed that the patient had bruxism occasionally. The patient requested his treatment to be completed at the earliest due to social reasons, the most aesthetic material to be used and only teeth 11 and 21 to be treated because of financial reasons.

Figure 1

Figure 2

Panoramic film of the patient was evaluated, and oral examination was performed, no endodontic treatment was required in the central teeth. It was informed that there might be a color difference especially due to the composite treatment at number 12. Night guard treatment was recommended to the patient because of bruxism and the patient was informed about laminate treatment being contraindicated. No obstructive factor was found in the occlusal height in the evaluation made. The patient was further evaluated period ontically and no discomfort was found.

After clinical and radiographic examinations, it was decided that the most suitable material for meeting the aesthetic expectations of the patient was CEREC Blocs (Figure 2). Due to the time limitation of the patient, it was deemed appropriate to perform the treatment with CAD/CAM technology. According to the treatment plan made, before starting to the preparation phase, the tooth color of the patient was selected using the IPS empress color scale in the daylight. While choosing the color, number 22 and opposite arc were taken into consideration rather than number 12, where the composite restoration was extensive. A preparation with chamfer finishing line was performed on the patient's teeth numbered 11 and 21. In order not to reduce the retention of the restoration due to the size of the central teeth, care was taken not to shorten the length of the tooth. During the preparation of the proximal surfaces, a flame bur was used to prevent any possible damage that could be occurred at the neighboring teeth. The finishing lines formed were even at all aspects and sub gingivally formed without causing any harm on the gingival tissues (Figure 3,4). Since the sharp edges on the tooth during milling in the CAD/CAM system would cause problems on the inner surface of the crown, the preparation was made by creating rounded edges.

Figure 3

Figure 4

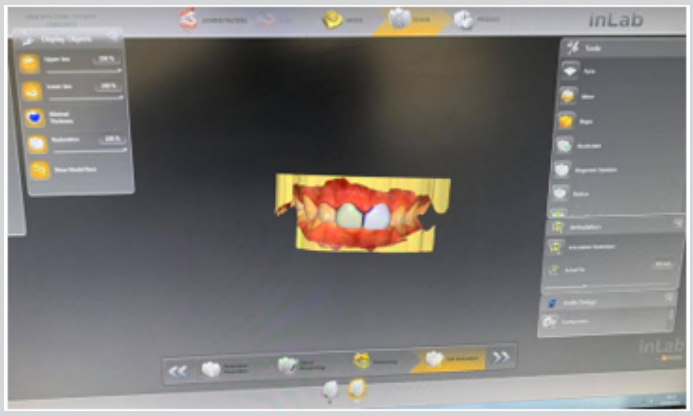

Figure 5

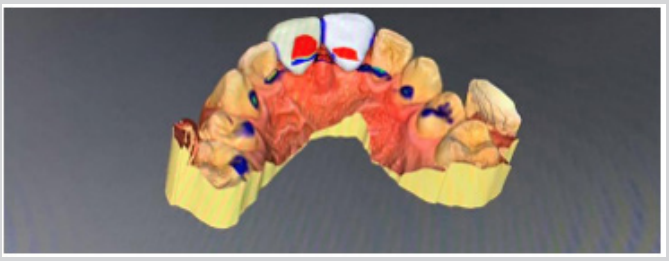

Figure 6

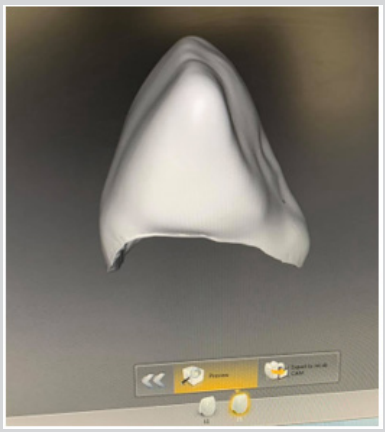

Figure 7

After preparation process was completed, the patient was scanned intraorally with the help of Sirona Omnicom. The data obtained was transferred to the in-Lab MC X5 for computer aided production (CAD/CAM). The restoration boundaries were marked on the optical impression transferred to the computer, and the volume and shape of the restoration to be used were determined. Each crown was milled separately to have better aesthetic properties and to provide ease of hygiene to be able to intervene easily in

case of any problem that could happen in the future (Figures 5-8). Standard glazing was applied at a temperature of 930 degrees. The milled crowns were rehearsed in the patient's mouth on the same day, shaped according to the patient's wishes, height control was made with articulation paper, controls were made so there were no overlapping points during lateral movements and then subjected to the glazing procedure. For the cementation process, hydrofluoric acid at a concentration of 5-10% was applied onto the internal surface of the crown for approximately 60 seconds, and carefully washed and dried afterwards. The chemical bonding between feldspathic porcelain and the tooth surface is provided by the silane bonding agent in adhesive resins [6]. For this reason, silane was applied into the crown for 30 seconds and dried. Subsequently, cementation was done using Bis-Cem (Bisco, Schaumburg, IL, USA) cement material and carefully cleaned before it hardened completely (Figure 9). The patient was informed about the need for reducing the forces coming to the anterior region and the biting movements as much as possible, and an appointment was arranged for the following week for the fabrication of the night guard.

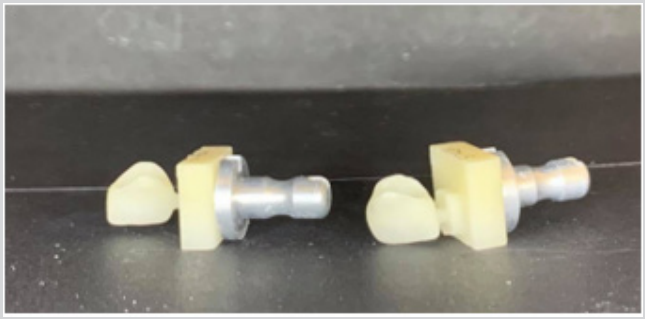

Figure 8

Figure 9

DISCUSSION

Despite giving successful results in the restorations made in the anterior region, composite restorations are prone to discoloration and fracture over the time. Prosthetic rehabilitations offer a good alternative treatment choice for the patients with high aesthetic demands in the long term. The treatment being completed in a short time, less materials being used, and the ease of production make CAD/CAM system the preferred modality of all-ceramic restorations [7]. The millable feldspathic porcelain is one of the oldest blocks used in CAD/CAM dentistry. Popular brands include CEREC Blocs (Dentsply Sirona, York, Pennsylvania) and VITABLOC (Mark II, Real Life, TriLuxe, VITA Zahnfabrik), and these have color and translucency options to better match with the natural teeth [5]. The CEREC blocks used in this case have a bending strength of 120MPa and have enamel-like wear properties. They are indicated for the use of a single crown in the anterior region [5,8]. However, one disadvantage of the porcelains used in block forms is the limitation of color selection due to their monochromatic nature [9]. Recently used polychromatic blocks can imitate natural tooth tissue as they possess different color saturation and light transmittance. Thus, by replicating the optical properties of the natural tooth, it is ensured that the existing natural dentition and the restoration make a whole [10]. Nonetheless, the restorations obtained with monolithic blocks can be given personal effects by applying external painting and glazing procedures like traditional methods [9].

Due to its durability and versatility, CAD/CAM lithium disilicate glass ceramic and zirconium-reinforced lithium silicate ceramic blocks can be used in the production of numerous types of restorations, such as inlays, onlays, partial and full crowns, implant abutments and 3-member fixed partial dentures [11]. However, in patients with severe bruxism, zirconia-based CAD/CAM ceramic blocks are recommended due to their high mechanical resistance [12]. In this case, feldspathic ceramic was preferred because the patient's bruxism was periodic, and the patient accepted the use of night guard.

The most important advantage of CAD/CAM high-strength glass ceramics is the ability of adhesive cementation [13]. Adhesive cementation is recommended to increase the limited bending strength of glass ceramics and to reduce their brittleness. Glass-ceramic restorations supported by adhesive cements with positive physical properties can show resistance to high masticatory forces and improved clinical performance [6,14]. In addition, in glass ceramic restorations, hydrofluoric acid etching rather than sandblasting is very effective due to their high glass content, and they give more successful results in adhesive cementation

compared to oxide ceramics [15]. Roughening the porcelain with 5-9.5% hydrofluoric acid, dental tissue with 3% phosphoric acid and the application of a silane bonding agent ensures that the adhesive resin cement binds strongly to the feldspathic material [16].

As in this case, the use of CAD/CAM has a great advantage in terms of completing the restoration in a short time. The CAD/CAM system, which was introduced to dentistry in 1985 and is still developing with improvements, has found a great place in this sector [7]. CAD/CAM allows the use of materials that cannot be used with traditional fabrication techniques. This type of ceramic processing provides regular microstructural arrangement, higher density, lower porosity, and reduction in residual stresses. The benefit of CAD/CAM systems used in the clinic is the design after the digital impression and the fabrication are carried out on the same day so that the treatment is terminated quickly; but the drawback is that it is costly and requires additional equipment [17]. In this case, the benefits of the CAD/CAM systems overwhelmed the drawbacks for fulfilling the expectations of the patient and satisfaction.

CONCLUSION

Nowadays, all the ceramic restoration manufacturing techniques have taken their places for being used in dentistry practice as single and multi-member fixed prosthetic restorations in a reliable way. At every stage of the treatment, the dentist should consider and eliminate the factors that may endanger the durability of the material by taking advantage of existing literature. Preferring the most appropriate material to be applied in the cases will increase the rate of success and patient satisfaction.

REFERENCES

1. Goldstein RE, Nimmons KJ, Daniels AH, Barnes C (2018) Maintenance of esthetic restorations. Ronald E Goldstein's Esthetics in Dentistry, pp. 1408-1429.
2. Guess PC, Kuliš A, Witkowski S, Wolkewitz M, Zhang Y, et al. (2008) Shear bond strengths between different zirconia cores and veneering ceramics and their susceptibility to thermocycling. Dent mater 24(11): 1556-1567.
3. McLaren EA, White SN, Dentistry S (2000) Survival of In-Ceram crowns in a private practice: A prospective clinical trial. J Prosthet Dent 83(2): 216-222.
4. Sadowsky SJ (2006) An overview of treatment considerations for esthetic restorations: A review of the literature. J Prosthet Dent 96(6): 433-442.
5. Sulaiman TA (2020) Materials in digital dentistry-A review. J Esthet Restor Dent 32(2): 171-181.
6. Türkoğlu P, Bultan Ö, Öngül D (2010) Tam seramik restorasyonlarda dayanıklılığı etkileyen faktörler. Journal of Istanbul University Faculty of Dentistry 44(1): 45-53.
7. Susic I, Travar M, Susic M (2017) The application of CAD/CAM technology in dentistry. IOP Conference Series: Materials Science and Engineering 200(1): 012020.
8. Anusavice KJ (2002) Microstructure, composition and etching topography of dental ceramics. Int J Prosthodont 15(2): 159-167.
9. Ardlin BI (2002) Transformation-toughened zirconia for dental inlays, crowns and bridges: chemical stability and effect of low-temperature aging on flexural strength and surface structure. Dent Mater 18(8): 590-595.
10. Reich S, Hornberger H (2002) The effect of multicolored machinable ceramics on the esthetics of all-ceramic crowns. J Prosthet Dent 88(1): 44-49.
11. Elsaka SE, Elnaghy AM (2016) Mechanical properties of zirconia reinforced lithium silicate glass-ceramic. Dent Mater 32(7): 908-914.
12. Guess PC, Schultheis S, Bonfante EA, Coelho PG, Ferencz JL, et al. (2011) All-ceramic systems: laboratory and clinical performance. Dental Clinics 55(2): 333-352.
13. Deniz DD, Aktaş ÖÜG, Güncü ÖÜMB (2019) CAD/CAM yüksek dayanımlı cam seramikler CAD/CAM high strength glass ceramics. Yeditepe J Dent 15(2): 224-230.
14. Bindl A, Richter B, Mörmann WH (2005) Survival of ceramic computer-aided design/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont 18(3): 219-224.
15. Höland W, Frank M, Rheinberger V (1995) Surface crystallization of leucite in glasses. Journal of Non-Crystalline Solids 180(2-3): 292-307.
16. Chen JH, Matsumura H, Atsuta M (1998) Effect of different etching periods on the bond strength of a composite resin to a machinable porcelain. Journal of Dentistry 26(1): 53-58.
17. Fasbinder DJ, Dennison JB, Heys DR, Lampe K (2005) The clinical performance of CAD/CAM-generated composite inlays. J Am Dent Assoc 136(12): 1714-1723.