



AESTHETIC IMPACT OF ZIRCONIA BASED PROSTHETIC RESTORATIONS - TECHNOLOGICAL ASPECTS

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Abstract: CAD-CAM technology has become the option of choice for making prosthetic parts, because this technology has helped a lot in the discovery of an extremely important material, namely, zirconium oxide (zirconia). As a major advantage, zirconium oxide offers a superior aesthetic to other prosthetic restorations. In the present material, we have tried to present in detail, the manufacture of a zirconium oxide based fixed multi-denture prosthetic restoration located in the maxillary frontal and lateral region, insisting mainly on the laboratory stages.

INTRODUCTION

We live in a time when technology has become man's best friend, due to the fact that it has grown rapidly and continues to grow more and more in all areas, primarily facilitating the exhausting work of each person and, at the same time, bringing to light more and more new, diversified and helpful methods in carrying out daily actions.

Within the dental practice in general, but also in the dental technique in particular, the technology used that has revolutionized this field is the CAD-CAM system. It consists of a scanner, a computer system that has a 3D software for processing the information taken by the scanner and a milling unit, which processes the data made in the aforementioned software.(1-5)

AIM

In recent decades, CAD-CAM technology has become the option of choice for making prosthetic parts, especially fixed ones, because, in addition to being a computerized system and eliminating human error, this technology has helped to discover an extremely important material, namely, zirconium oxide. Also known as "Zirconia", it is often used as a treatment solution, becoming the star of dentistry in this second decade of the 21st century.(1-5)

With the discovery of Zirconia, many patients and dentists agreed to use zirconia based ceramic restorations because, among many other benefits, zirconium oxide offers superior aesthetics then other prosthetic restorations.(1,6-8)

One of the most important advantages of zirconium oxide is the biocompatibility of this material with both soft tissues and ceramic masses. Upon contact with these tissues, Zirconia behaves approximately like a natural tooth, not affecting the periodontium in any way and not producing allergies to it. At the same time, another advantage that must be taken into account is that of a superior aesthetics, especially in the classic prosthetic restoration and / or implant-supported as aesthetic as possible of some edentations localized in maxillary frontal areas.(6-10)

Thus, in the present material, we tried to present in detail, using well-made images, the making of a fixed prosthetic restoration on zirconium oxide with localization in the maxillary frontal and lateral region, insisting mainly on laboratory stages.

MATERIALS AND METHODS

CAD/CAM technology is an innovative technology, used in various fields, for the 3D / 2D design of prosthetic restorations and not only, based on specialized software.

This technology has revolutionized traditional dentistry, marking the beginning of the dentistry of the future. With the help of this system, the quality of the prosthetic parts made can be improved, provided that it is not limited to simulation in the sense of imitation, but also to the computerized representation of real values and sizes.(1-4) Also, CAD/CAM was discovered with the intention of solving 3 problems, which hindered the success of the therapeutic act. The first problem was to ensure adequate restoration resistance, especially for the posterior teeth on which higher masticatory pressures act. The second problem refers to the realization of teeth that look as natural as possible, the physiognomy being more important in the case of teeth in the frontal area. The third challenge was to obtain restorations more easily, in the shortest possible time and with the greatest accuracy.(1-4)

At the same time, CAD/CAM technology was introduced in dentistry, favouring the design and 3D visualization of future prosthetic restorations, by scanning dental abutments using an optical scanner and designing the final prosthetic work. The following prosthetic crowns can be obtained: full zirconia crowns (e.g., Prettau®), mixed crowns (zirconia-based ceramic), pressed ceramic crowns (e.g., IPS e.max CAD), temporary PMMA crowns, wax frameworks for cast metal technology, milled metal crowns, sintering metal crowns in both partial and total prosthesis. This system is also used in orthodontics.(1-4,11-13)

This revolutionary technology for dental prosthetics has also been used to make the multiple teeth prosthetic restoration on zirconium oxide (or Zirconia), the realization of

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which we will present below.

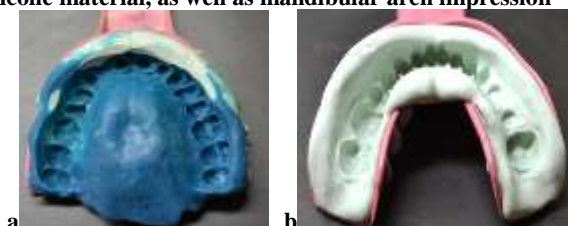
RESULTS

Patient J.Y., aged 47, presented to the dentist's office with various destructions and discolorations at the level of the upper arch, more precisely at the level of the upper frontal group and of two premolars.

Following the anamnesis, the intraoral examination, the radiographs and the presentation of the different methods for solving the physiognomic and masticatory dysfunction, the dentist together with the patient arrived at the following treatment solution: zirconium oxide based ceramic overlays, at the level of 1.4, 1.5, 2.4, 2.5 and a zirconium oxide based ceramic bridge from 1.3 to 2.3 (1.3, 1.2, 1.1, 2.1, 2.2, 2.3).

On the zirconium oxide infrastructure made with IPS e.max ZirCAD by means of CAD-CAM technology, the IPS e.max Ceram ceramic will be layered.

Figure no. 1-a, b. Functional impression made with addition silicone material, as well as mandibular arch impression



Teeth preparation was followed by the functional impression of the maxillary arch, with the help of an addition silicone addition of putty and fluid consistency using wash technique. The mandibular arch was imprinted with an alginate material. Based on the occlusal registration, the two models were mounted in the articulator.

Figure no. 2. Master cast and opposing arch cast mounted in the articulator



Figure no. 3 – a, b. Master cast (maxillary) and opposing mandibular cast scanned



Figure no. 4. Zirconium oxide infrastructure created by CAD-CAM technology on the master cast



The zirconia substrate for prosthetic restorations was made using CAD-CAM technology. The two models were scanned for virtual models, and then mounted in the virtual articulator. According to the design of the future restorations, they were obtained by milling.

Figure no. 5. The fitting of zirconium oxide infrastructure is checked on the natural teeth of the patient



In order to avoid errors in this phase, the fitting of the zirconia structures on the teeth and to the soft tissues was verified. Subsequently, the ceramic mass was applied to the zirconia substrate.

Figure no. 6. After adjustment of infrastructure based on dentist requirements, the liner necessary for ceramic mass was applied and fired



The application of dentin and enamel masses was made with the individualization of the teeth and the respecting the morphological characteristics for the restored teeth but also of the spaces for the gingival papillae.

In successive stages, the liner, dentin mass and enamel were applied. These were followed by heat treatment, and in the end the shape was corrected and the glaze layer was applied.

Figure no. 7. Application of the first ceramic layer consisting of Deep Dentin and Dentin Body



Figure no. 8. First layer of ceramic applied on zirconium oxide substrate



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Figure no. 9. First layer of ceramic after firing



Figure no. 10. The applying of the second layer of ceramic



Figure no. 11. Processing the second layer of ceramic after firing, guiding lines traced to facilitate this stage



Figure no. 12. Applying glaze on surface of prosthetic restorations



Figure no. 13. Final aspect of prosthetic restorations on the master cast, frontal view



Figure no. 14. Prosthetic restorations cemented on teeth



DISCUSSIONS

Defects that appear at the level of dental structures, regardless of their nature, can be reconditioned with the help of prosthetic restorations, single tooth or multiple teeth, depending on the affected surface (s).

The roles of these prosthetic parts are represented by the reconditioning of the aesthetic aspect, by restoring the morphology and by the reintegration in the harmony of the dento-maxillary system, by restoring the lost functions.(14-16)

Ceramic masses are the material of choice in making prosthetic parts, as they have an ideal chromatic, similar to the natural dental structure, through an increased translucency. Along with this aesthetic advantage, through its increased resistance to breakage and wear, dental ceramics also help to restore the functionality of the prosthetic work.(17-20)

Dental aesthetics is based on the most accurate rendering of the morphology of the dental crown and by chromatics reproduced as naturally as possible and similar to the natural tooth. To these are added the creation of optical illusions and the observance of ideal proportions.(21-24)

Today, CAD-CAM technology has revolutionized the practice of prosthetics everywhere. This technology has helped to make prosthetic restorations from certain materials that cannot be obtained using conventional methods, the best example being zirconium oxide, which has become increasingly used due to its superior aesthetics, increased precision and compatibility with the tissues adjacent to the dental structure that will be restored.(21-24)

However, CAD-CAM technology is not only a very precise technology, but also a very expensive one, quite laborious, which requires quite consistent investments both in terms of equipment and instruments, and especially in terms of materials used.

Specifically, although the efficiency of CAD-CAM technology is recognized at all levels, at this moment in Romania there are very large discrepancies in terms of income between different segments of the population, which makes it very difficult to implement this technology in all dental offices and of dental laboratories. However, both patients and dental professionals generally make consistent efforts to achieve joint prosthetic restorations on zirconium oxide, with a truly great aesthetic impact.(21-24)

CONCLUSIONS

The combination between ceramic masses and zirconium oxide infrastructures obtained through CAD-CAM technology that revolutionized the field of dentistry, prosthetic works have performed better than other types of restorations.

Due to its mechanical properties, zirconium oxide can successfully replace metal as a resistance substrate for ceramic masses. It can be used as a unique material for the complete restoration of dental crowns, or as a substrate for ceramic masses. Being an opaque material but with a color close to the hard dental tissues, zirconium oxide also has the role of shielding unsightly colors from dental abutments.

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The advantages of using zirconium oxide make this material a future one, the widespread use of which also implies the decrease of production prices in the medium and long term.

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