The Use of Colour Codes in Ceramics Build-up for Achievement Esthetic Anterior Restorations

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The ability to mimic the optical characteristics of enamel and dentin, the excellent biocompatibility and the chemical durability of dental ceramics are the reason reasons why this topic is considered of great importance in dentistry. The aim of this study was to highlight the differences during the process of manufacturing anterior esthetic restorations, i.e. the proper selection of color shades of dental ceramics and their correct deposition. Techniques for performing aesthetic ceramic restorations are influenced by the experience of the dental technician and their skills in realizing the restoration, which should be as little complicated, even if the dental ceramic powders has coded shades of color. Some dental technicians prefer their own color labels in order to facilitate their work and to modify or to highlight some effects of the powders, during the dental ceramics build-up. Naturalness of eight anterior restorations was obtained by alternating the opalescent base layer of the dental ceramic layers was used in order to create the true aspect of the incisal area, with a natural halo appearance. The increasing expectations of the patients in aesthetic restoration of anterior area of dental arches demand a complex build-up of the porcelain layers and this technique requires that the dental technician to possess special skills for obtaining a successful result.

Keywords: dental ceramics, opalescence, fluorescence, shade of colors, successful esthetic restorations

The ability to mimic the optical characteristics of enamel and dentin, the excellent biocompatibility and the chemical durability of dental ceramics are the reason for them being such a hot topic in dentistry [1,2].

such a hot topic in dentistry [1,2]. There are three dental ceramics main divisions: predominantly glassy materials which are highly esthetic, particle-filled glasses, and polycrystalline ceramics which are ceramics with substructures of high strength. Any ceramic within this spectrum can be considered as being a composite dental ceramic [3-5].

The availability of different dental ceramic systems provides solutions for different types of restorative problems in esthetic dentistry, from conservative to extensive [6].

In present, alumina and zirconium-based ceramics are the latest materials used for fixed partial dentures core and ceramic crowns [7].

The purpose of this study has been to highlight the differences between a complex ceramic build-up and a simple build-up in the anterior teeth from an esthetically point of view.

Experimental part

Material and methods

There are many porcelain systems and techniques currently available for utilization in full-coverage anterior crowns restorations. Because of the advancements made in the placement of margins and the reduction of the metal framework thickness, is now possible to enhance the optical effects of anterior esthetic restorations. In this regard we present several recent developments in the realization of mixed metal-ceramic esthetic restorations and we demonstrate that the dental technician must possess special skills for obtaining a successful result in the esthetic oral rehabilitation.

In the first situation we have used a gypsum model with preparations on the maxillary anterior group of teeth. Two fixed metal-ceramic restorations were realized by using the complex ceramic build-up for 1.1, 1.2 and 1.3 and a simple ceramic build-up on 2.1, 2.2 and 2.3.

The models were casted by IV-th type of gypsum, for a die system from Bredent. A silicone matrix has been realized in order to guide us in the future steps of configuring the metallic frames of the two restorations (Zetalabor) (fig. 1).



Fig. 1. The gypsum model with the wax-up of the metal-ceramic restoration

The wax-up of the metal coping was made by using the immersion method and by employing a special memory wax from Bredent (fig. 2).



Fig. 2. The wax-up for the metal copings and the use of the silicone matrix

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The investment was completed in two steps. The first step was to apply a liquid investment material on the external and internal surfaces of the wax-up of the metal copings prepared for investing. The second step was to complete the procedure by adding a classic investment material from Bego. After the preheating and the heating of the invested pattern, the molten alloy (Niadur) was casted into the mold by using a low-frequency induction casting machine (Ducatron Serie 3).

After devesting procedure, the metallic framework was adapted on the model and sandblasted. Prior to the application of the opaque, the metal frame was submitted to an oxidation firing in the porcelain furnace. The oxide layer was then sandblasted with aluminum oxide. Two layers of opaque were applied on the metallic structures, but the future complex build-up restoration was conditioned with an extra layer of fluorescent crystals, in order to give a more natural effect to the final stratification (fig. 3).



Fig. 3. Fluorescent crystals have been applied on the opaque surface of one of the fixed restorations

Organic dies like carmine for red, carotene for yellow and brilliant blue for blue were used in order to color code the ceramic powders and to ease the stratification process. The first layer of dental porcelain, applied on the metallic framework benefited the complex build-up, the *inside* ceramic powder with opaque, which have also highly saturated effect. On the *inside* layer, the build-up continued with layers of base dentin, opaque dentin, fluo dentin and a thin layer of CL-F (clear fluorescence). The enamel layer started with EOP3, a grey opalescence enamel, applied in the incisal and proximal areas. Then, transparent, clear fluorescence and enamel opalescence were alternatively placed and the final contour was completed with base enamel and occlusal enamel (EO-15) (fig. 4).



layers

Lustre-pastes were used in order to individualize the final restoration (figs. 5, 6).



Fig. 5. Complex versus simple ceramic build-up



Fig. 6. Complex versus simple ceramic build-up (macro)

In the restoration which benefited a simple build-up technique, only three ceramic powders were used, consisting in an *inside* layer, a layer of dentin and a final enamel layer.

In the other seven clinical case, we followed the same stages that were described above, with the realization of the complex ceramic build-up for the metal-ceramic restoration on anterior left dental hemi-arches, and deposition of 3 ceramic layers for the anterior right dental hemi-arches (figs. 7-8).



Fig. 7. The completion of the complex porcelain build-up before firing



Fig. 8. The final aspect of the restoration - macro

Result and discussions

The mixed metal-ceramic restorations achieved by complex build-up technique presented esthetic shades of color in comparison with the fixed restorations obtained by the deposition of 3 ceramic layer on the metallic framework.

Excellent aesthetic results still require skillful technicians in metal-ceramic systems. In the same time, the continuous communication between the members of the restorative team, as well as the use of advanced ceramic layering technique, are necessary requirements for achieving successful esthetic restorations.

Metal-ceramic fixed restorations obtained by depositing 3 ceramic layers are enough known well and require less special knowledges for their routine use.

Naturalness of anterior restorations was obtained by alternating the opalescent base layer of the dental ceramic and the fluorescence of crystalline layers subsequently applied over opaque. Different translucent type of ceramic layers was used in order to create the true aspect of the incisal area, with a natural halo appearance.

Some dental technicians prefer their own color labels in order to facilitate their work and to modify or to highlight some effects of the powders, during the dental ceramics build-up. The increasing expectations of the patients in aesthetic restoration of anterior area of dental arches demand a complex build-up of the porcelain layers and this technique requires that the dental technician to possess special skills for obtaining a successful result.

Metal-ceramic technology has come a long way since its beginnings in dentistry. Since 1950's refinements in metal ceramic systems dominated dental ceramic research to overcome limitation like high thermal conductivity of metal which may sometimes results in adverse pulpal response, radiopaque nature of metal, increase devitrification, microscopic corrosion which reduces longevity of restoration, patient's sensitivity to metal element and most important limited transmission of light [8].

Although the trend in modern dentistry is to use metalfree restorations, metal-ceramic restorations, which combine the good mechanical properties of alloys with the excellent esthetic properties of porcelain, are still used most frequently for making fixed partial dentures and single crowns [9].

The use of base metal alloys has made high quality treatment possible for a large number of patients, with limited financial means, in developing countries [10]. These base metal alloys are superior to noble metals in several aspects, such as their low density, excellent hardness, and tensile strength. Another advantage of the base metal alloys is that thick oxide layers form easily on the surface of this metals and the presence of an appropriately thick oxide layer on the metal surface is essential for it to adhere to porcelain by chemical bonding [11].

There are a lot of factors that may or may not be addressed when we talk about the esthetics of the metalceramic restorations. Marked color changes can occur due to repeated firings of the ceramic structure compared to the initial firing [12]. The ions in the metal-substructure may also contribute to the color change in the porcelain after repeated firings [13]. Nickel ions are colorants that produce a neutral gray color in sodium silicate glasses and are likely associated with color changes in porcelain. Also, during the bulk transfer elements migrate from the alloy to the porcelain throughout interface. Color changes can also occur to some extent due to the insufficient smoothing of the natural glaze method of metal ceramic restorations because of the microstructural features [14].

The ability to match the shade of a metal ceramic crown to that of a natural tooth remains the chief problem associated with aesthetics in the prosthodontic field [15]. To the majority of patients, the aesthetic appearance of a restoration often has more impact than its biological compatibility and function. While technological advancements have significantly improved the procedures and biomaterials utilized to fabricate metal ceramic restorations, the definitive result must address these increasing aesthetic expectations. A means of properly matching a crown restoration with the surrounding natural dentition is therefore critical [16].

To improve his forms a technician has to make sure his hands reproduce what he is seeing at that particular moment and not what his mind has seen in the past. That is why a wax-up of the final restoration should be used as a guiding tool. In the same way, a caliper and a ruler can be used in order to help us establish the appropriate size and shape of the future restoration [17].

Different porcelain layering and finalizing the contour, adding texture with natural glazing and using special polishing techniques must be used for the best results [18]. Traditional metal-ceramic restorations still have the primary requirements of high strength, good esthetics and long survivability in the oral environment. As the goal of any oral rehabilitation process is to provide functional and esthetic outcomes, harmony of the oro-facial system and improve patient's quality of life, metal-ceramic restorations are still considered an excellent treatment alternative [19].

Many practitioners are likely unaware of which metalceramic system is used in their laboratory and if they can use the system for suitable anterior single-unit or posterior multi-unit restorations [20].

The requirements for an acceptable dental material are many, but one of the most important is the biocompatibility. Furthermore, it should contain no toxic, leachable, or diffusible substances that can be absorbed into the circulatory system, causing systemic responses, including teratogenic or carcinogenic effects [21].

Conclusions

- The complex build-up of the porcelain addresses for very increasing aesthetic expectations of the patients.

- In obtaining successfully results, the complex build-up technique requires special skills of the dental technician, because porcelain build-up techniques are highly influenced by the dental technician's experience and his way of making this process less complicated than it tends to be.

- There were certain aesthetic differences between the two compared techniques in achievement esthetic restorations and in the esthetic results, and the clear winner in terms of natural aesthetic aspect were represented by the metal-ceramic restoration realized by using the complex porcelain build-up technique.

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