

Restoring a Maxillary endodontically treated Central Incisor: The Aesthetic Challenge

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Abstract

The restoration of an endodontically treated central incisor is a major challenge to the clinician in his daily practice. In fact achieving a natural mimicry of the single maxillary central incisor restoration with the adjacent dentition is a real challenge. An anterior dental restoration must be able to restore proper function, aesthetics and confort for the patient. A large variety for aesthetic treatments in the anterior dentition from the less invasive to the most invasive, ; such as tooth bleaching, direct composite restorations, ceramic veneers or full coverage crowns. The choice of the suitable treatment option depends on characteristics and severity of dental defects or tooth decay. Crowning an anterior too this indicated when there is extensive coronal destruction and we can't do a direct restoration. In a recent systematic review, endodontically treated teeth restored with crowns had higher long-term survival after 10 years ($81 \pm 15\%$) compared to teeth without crowns ($63 \pm 15\%$) [14] This review also showed that the survival rate of crown-free root fillings was satisfactory in the first three years ($84\% \pm 9\%$), but decreased significantly after that [18]. Many materials can be used for crowns: metal, ceramics or zirconia. Nowadays, the ceramic systems made it to restore the symmetry, color, shape and incisal translucency. This clinical report describes the treatment of a discolored and endodontically treated central incisors and to show the different guidelines to guarantee a natural mimicry using a zircon abased ceramic restoration.

Introduction

The maxillary central incisors have an effect on the visual aspect of a person either positively or negatively [5]. Any defects of these teeth, such as caries, chipping, fracture, in aesthetic restorations, discolorations, anomalies of the shape or position within the dental arch, may cause restrictions in the social life of affected patients [13].

The mimicry of natural teeth, especially with single-tooth restorations, represents a challenge for both the practitioner and the ceramist [1]. The individuality of each single human tooth makes it difficult to create a single anterior restoration that matches harmoniously the existing adjacent teeth.

A large variety for aesthetic treatments in the anterior dentition from the less invasive to the most invasive, ; such as tooth bleaching, direct composite restorations, ceramic veneers or full coverage crowns [13].

A partial coverage restoration may be strong and effective, but only if a dental problem is minor and affects only a portion of the tooth.

Thus in major cases of endodontically treated teeth, the prosthetic full coverage restoration is a secure, long-lasting solution that protects the entire tooth and restores full function.

Many materials can be used: metal, ceramics or zirconia.

Metal-ceramic crowns are the most types of crowns used in dentistry. They have been around for over 50 years.

They provide both great aesthetics and durability. But these crowns will corrode and these may cause a grey line at the gum line. So tismay not give the 100% aesthetic look.

Also these do have an electrical conductivity so there will pains even if the patient drinks hot or cold beverages.

Ceramics are considered to be the best in mimicking the natural tooth appearance thanks to their optical properties the way light passes through and is reflected off a natural tooth.

There is a wide range of available ceramic systemes. Choice depends on the clinical case [22].

The right ceramic system is not the only guarantee for a predictable aesthetic outcome, it's also proper soft tissue control, tooth preparation, good and clear communication with a professional ceramist.

Clinical Report

M.O was a 26-year-old male patient referred to the fixed prosthodontics department, with a chief complaint of unattractive smile because of his defective composite restoration. He was asking for an aesthetic solution

Complete history of the patient along with preoperative photograph was taken. Medical history was non-contributory.

The intraoral examination showed

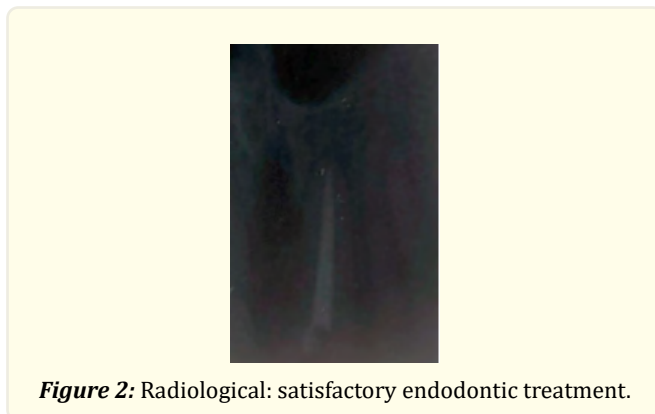
Soft tissues were evaluated as healthy and oral hygiene as well. The tooth 21 was restored with proximal omposite (figure1) that was repetitively lost.



Figure 1: Retracted preoperative full-mouth view showing discolored margins of resin.

The occlusion examination: was analyzed preoperatively.

Radiological evaluation revealed: satisfactory endodontic treatment of the tooth 21 (figure2).



A Diagnostic impression was conducted and casted the diagnostic cast was then waxed-up.

- The tooth was prepared with internal rounded shoulder at a sub gingival level conducting to sufficient facial tooth reduction in order to secure the thickness of the restoration for discolored tooth masking. This allows a thickness of 1.2 mm of porcelain and 1.5 to 2 mm incisally.
- Proximal walls are ideally tapered between 6 and 10°. They should be rounded with no sharp angles so as to avoid any internal stress in the crown.

Once the preparations undertaken, a provisional restoration was fabricated using auto-polymerized resin using the putty index made from the wax up. It's then and cemented. (figure3).



The shade was determined with a 3D master shade guide from vita.



A complete arch impression was made with a silicone impression material (HydroC, Detax, Germany) (a combination of heavy -low and light silicon) (figure 5).

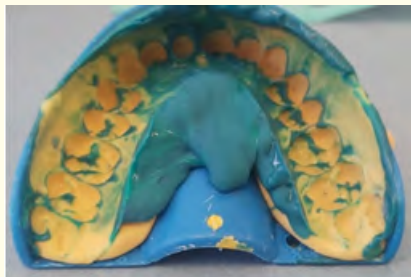


Figure 5: Master impression.

In laboratory, the working cast was scanned and framework was manufactured after thanks to computer-assisted design CAD/CAM indirect technique. (figure 6).



Figure 6: Zirconia framework.

A try in of the Zirconia framework to verify the insertion, retention, marginal integrity and mostly the space left for cosmetic ceramic (figure 7).



Figure 7: A try-in of the Zirconia framework.

Then, ceramic stratification was performed in the laboratory. (figure 8)



Figure 8: Final restoration.

A final try-in, of the zirconia based ceramic crown was achieved to verify esthetic, occlusion relationship and marginal integrity before final staining and glazing.

Once validated, the zirconia crown was cemented using glass ionomer resin forced by resin (figure9).



Figure 9: intra oral view of the ceramic restoration.

The tooth shade was in harmony with the surrounding dentition.

At the end of the treatment, the patient was pleased with the results and no longer hides his smile (figure 10).



Figure 10: Final result.

Discussion

The project of the restorative treatment of a single discoloured central incisor with a defective composite restoration, requires careful planning. That is why the dentist has to decide for the best treatment option to ensure an optimal result providing clinical longevity of incisors and esthetic outcome.

A large variety for aesthetic treatments in the anterior dentition from the less invasive to the most invasive, ; such as tooth bleaching, direct composite restorations, ceramic veneers or full coverage crowns [13].

Tooth staining can be improved by a number of approaches including bleaching procedures. But this technique maybe not sufficient to obtain a good aesthetic result which requires a prosthetic treatment.

Resin composite veneers are used to mask tooth discolorations. Although composite resins is easy to manipulate, they have limited longevity because of their undesired properties such as low abrasion resistance, and plaque accumulation [24] compared to porcelain veneers that have high abrasion resistance, color stability, excellent aesthetic results and predictable longevity [25].

The ceramic veneer option could not be was not considered because of the large composite restoration sealing the endodontic access cavity at the palatal surface, which significantly reduced the stiffness of the tooth [26]. Shu et al stated that there was a weak recommendation of indirect restoration to restore endodontically treated especially for the teeth with extensive coronal damage [27].

However, full coverage crown restorations are widely accepted in restorative dentistry. Since it's the restoration that will ensure a full coverage for the restored crown.

Metal ceramic crowns represent the main non adhesive restoration of the anterior dentition.

Meta-analysis of the included studies indicated an estimated survival rate of metal-ceramic crowns of 94.7% (95% CI: 94.1-96.9%) after 5 years.

Which made of it a gold standard of full coverage restorations.

The metal substructure must be masked by placing a layer of very opaque (chalky-white) porcelain over it to enhance the aesthetic outcome of the metal-ceramic crown.

But these crowns will corrode and these may cause a grey line at the gumline. So tismay not give the 100% aesthetic look.

Also these do have a electrical conductivity so there will pains even if the patient drinks hot or cold beverages.

Therefore, all ceramic restoration were found.

The absence of opaque metal substructure in all ceramic restorations provides a deeper translucency similar to natural tooth which was described as one of the primary factors in controlling esthetics [17].

In the last three decades, many different all-ceramic systems have been introduced to the dental profession [2].

The selection of the ceramic material depends on factors unique to each patient for that there is no a single ideal material for every case.

Meta-analyses of included studies provide estimated 5-year survival rates Made of leucite or lithium disilicate reinforced glass-ceramic crown (96.6%), made of glass infiltration Alumina crowns (94.6%; 95%; and densely sintered alumina and zirconia crowns (96%; 95%; 95%) [28].

This choice requires basic knowledge regarding material properties and case selection [21].

The selection of materials for single-tooth crowns depends primarily on esthetic factors such as the color of the abutment tooth and the neighboring teeth, as well as their brightness value and translucency [21].

These components have to be optically harmonized to reproduce natural crown color. Assuming excellent color matching is verified in dental laboratory, it should be correctly transferred to the clinical setting [9].

The translucency of the ceramic system was described as an important factor that plays a great role in light behavior and in aesthetics [10].

However, when a translucent ceramic restoration is placed on a dark underlying tooth structure, such as an endodontically treated tooth, that not masks the underlying abutment tooth color and cause shadowing of the restoration, especially in the cervical area [7].

In this case the use of a silica-based all-ceramic crown is not recommended [23].

In all-ceramic systems, zirconia-based ceramics meet biomechanical requirements: chemical and Dimensional stability, high mechanical strength and fracture toughness [17].

Zirconia can be used to make two different types of crowns

- Monolithic' crowns made entirely of Zirconia, which are computer designed and milled from a single uniform block on a CAD/CAM machine. The advantage of these is that they are extremely hard and long lasting, However, due to the dense singular material, it can be hard to get an excellent shade match and they have minimal light reflective properties.
- Zirconia frameworks, they are not as strong as all zirconias, but are translucent More in line with the characteristics of natural teeth.

While, the zirconia frame is naturally white, which can have a negative effect of the final aesthetic appearance restorations [20].

Literature suggests that high-strength ceramics may be more opaque but they can be used to mask discoloration [7].

To improve the disappointing optical properties of traditional zirconia, a new generation of shaded zirconia was introduced.

This material is supposed to combine good mechanical and aesthetic properties allowing their use in the anterior and posterior sector thus requiring a thinner veneer to cover the underlying core mask [6].

To meet aesthetic goals and considering the patient's request, the treatment plan was Zirconia based crowns restoring the aesthetics of central incisors and improving its altered mechanical properties.

- The challenge of mimicry in the case of a single crown on the central incisor concerns two main parameters: color and morphology.

The reproduction of the shape is a similarly important parameter to achieve the perfect restoration. That's why after preparation, a temporary crown will immediately satisfy the aesthetic, functional and biologic requirements of both patient and dentist. Once this has been accomplished, time becomes a friend rather than an enemy and can be used by both dentist and technician to ensure success in all aspects of the final restoration [15].

For correct restoration colour match, clinician needs to have basic knowledge of light science. He is, responsible for creating a less confusing communication with the laboratory via some tools such as graphics, shade mapping cards, aesthetic checklists and a shade guide.

Many guides developed over the years to improve shade selection and facilitate communication with the prosthetist.

Among the guides, the vita 3d master is the most recommended: it allows to evaluate the luminosity as the most important part. They also need special colors watches Opalescence, Fluorescence and Translucency of Natural Teeth [19].

A color map with all internal and external features, variations in Chroma and translucency, and incisal edge irregularities is drawn. They are all identified, recorded and communicated to the dental ceramist.

The patient's aesthetic expectations are normally very high and the final result is highly dependent on the dental technician. It is usually necessary for the technician to spend time with the patient at various stages while fabricating the crown [14].

Using reliable indices for objective aesthetic evaluation is a fundamental step in order to monitor the results over time; as pink/white aesthetic score (PES/WES). According to literature, WES/PES index was essentially recommended to evaluate supported implant restorations, but It's validity for natural tooth was discussed recently by authors [12].

The PES index was based on the following 7 variables: Mesial papilla, distal papilla, the height and curvature of the facial mucosa, Convexity of the root, Color of the soft tissue, Soft tissue texture at the facial side of the implant.

Using a 0-1-2 system, zero being the lowest and two being the highest value, the highest possible score would be 14 and the threshold of clinical acceptance was set at 6.

The WES index was based on the five following parameters: general tooth form, outline and volume of the clinical crown, color including the assessment of hue and value, surface texture, translucency, and characterisation.

A score from 0 to 2 is given, with a maximum total WES was 10 and the threshold of clinical acceptance was set at a score of 6 [9].

Conclusion

Restoring single central incisor, according to the principle of dominance, remains a challenge for prosthodontists; for that some guidelines regarding the shade, proportions, size should be respected.

Communication, skills, artistic talent and material selection are the key to achieve success.

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