Case Report

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Esthetic Rehabilitation with Zirconia-based Shell Crowns: A case report.

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Abstract

A 50-years old female patient presented for treatment of the anterior maxillary teeth that had been restored repeatedly in the past with direct resin composite restorations.

The treatment plan for this patient included all-ceramic shell crowns on all anterior maxillary teeth and the premolars. Shell crowns were selected as the treatment option to ensure optimum esthetic result with increased strength on the cervical areas. A knife edge margin was created circumferentially on all prepared teeth. All-ceramic frameworks were fabricated from zirconium oxide and veneered in the layering technique. Full coverage zirconia- based ceramic crowns with knife edge preparations (shell crowns) can offer a good esthetic result with minimum tooth preparation combining strength and could be considered as a treatment option in selected clinical cases.

Introduction:

Providing a functional rehabilitation that fulfills the contemporary criteria of optimum esthetics, requires both meticulous treatment planning and appropriate material selection. The aim of the whole therapeutic effort should be focused on predictable and long-lasting clinical results. Among the treatment options the most conservative approach regarding sacrifice of tooth tissues is often preferred both from the patient and the clinician.

All ceramic shell crowns (also reported as 3600 ceramic veneers) are full-coverage crowns with knife edge preparations.[1] These restorations combine the mechanical strength of all ceramic crowns and the esthetic performance of veneers with minimal preparation at the cervical areas.[2,3]

The aim of this paper was to present a challenging clinical case with existing extensive resin composite veneers on the anterior maxillary teeth that were replaced by all-ceramic shell crowns.

Case Presentation:

A 50-years old female patient presented for treatment of the anterior maxillary teeth. The anterior maxillary teeth had been restored repeatedly in the past with direct resin composite

restorations covering the entire labial, mesial and distal surfaces. The restorations showed adequate shape and color but numerous crackings were noted in the marginal areas. Marginal periodontal infection was present despite the good level of the oral hygiene due to inadequate emergence profile and overcontouring of the existing restorations (Fig 1-3).

Fig 1: Initial clinical situation. Frontal view.

Fig 2: Initial clinical situation. Right side view.

Fig 3: Initial clinical situation. Left side view.

The patient reported night bruxism and occasionally tooth clenching during the working hours of the day. All anterior teeth were vital without need for endodontic treatment. The patient wished a permanent restoration of the anterior teeth without the disadvantage of chipping that had happened often in the past. She was satisfied with the shape and size of the anterior teeth but was also extremely worried about the final esthetic result that demanded to be natural looking.

After the clinical examination, initial alginate impressions were taken and study casts were fabricated. On the right side the second premolar (#15) was congenitally missing but there was not an increased gap. A full wax-up of all anterior maxillary teeth was accomplished. The premolars (# 14, 24 and 25) were also included as the patient had a wide smile revealing all anterior maxillary teeth (Fig 4).

Fig 4: The maxillary premolars are exposed to the smile.

The treatment plan for this patient included all-ceramic shell crowns on all anterior maxillary teeth and the premolars. Full-coverage shell crowns were selected as the treatment option to

ensure optimum esthetic result with increased strength on the cervical areas, taking under consideration the bruxism habit of the patient. Another factor that advocated full coverage was the surface of dentin that would probably remain exposed after removal of the existing composite resins.

On a duplicate cast from the wax-up, the teeth were prepared in the laboratory to the estimated depth and extension and a translucent thermoplastic sheet of 1mm thickness was prepared to serve as a guide for the preparation of the teeth to ensure adequate space for the planned restorations but also avoid unnecessary sacrifice of tooth tissue on the cervical areas. Provisional restorations (splinted shell crowns) were also fabricated from heat-polymerizing acrylic resin to the desired shape, contour and color (Fig 5).

Fig 5: Provisional restorations.

The teeth were prepared in a single clinical session removing the existing restorations. The proper depth of the preparations was verified by the use of the translucent thermoplastic sheet (Fig 6).

Fig 6: Checking the preparations with the thermoplastic sheet.

The provisional restorations (prefabricated in the laboratory) were relined and adapted (Fig 7).

Fig 7: Provisional restorations.

Alternatively a thermoplastic sheet from the full wax-up could have been used for chairside fabrication of provisional restorations. A knife edge margin was created circumferentially on all prepared teeth, as it can be observed more clearly on the working casts (Fig 8).

Fig 8: The tooth preparations on the working cast.

Upon insertion of the provisional restorations, both the clinician and the patient could evaluate the esthetic result (Fig 9).

Fig 9: Smile of the patient with the provisional restorations.

Three weeks later, after the soft tissues had healed properly, the final impression was taken using addition type polyvinyl-siloxane material and a working cast made of extra hard stone was fabricated. All-ceramic frameworks were fabricated from zirconium oxide (White Peaks Co, Essen, Germany) using a CAD/CAM system (imes-icore 450i, imes-icoreCo, Eiterfeld, Germany) and were tried on the teeth to verify precision of fit (Fig 10).

Fig 10: Try-in of the ceramic framework.

A pick-up impression was taken and a new working cast was fabricated that reproduced the gingival papillae (Fig 11).

Fig 11: Pick-up impression.

This step is important to ensure proper emergence profile of the crowns and avoid dark triangles in the interdental areas. The ceramic frameworks were veneered using porcelain (Vita Co, Bad Sackingen, Germany) in the layering technique. Following the final try-in the final restorations were cemented by dual polymerization cement (Panavia, Kuraray Co, Tokyo, Japan). The patient was completely satisfied by the esthetic result and also from the stability of the restorations (Fig 12-14).

Fig 12: The final restorations. Frontal view.

Fig 13: The final restorations. Right side view.

Fig 14: The final restorations. Left side view.

A night guard was given to the patient to ensure protection against bruxism. As she reported in the recall, she was no more worried about chipping in the marginal areas and could bite with the anterior teeth without hesitation.

Discussion:

The selection of porcelain-veneered zirconia-based restorations in this patient was the high fracture toughness of the ceramic framework based on the reported bruxism of the patient.[4] Additional advantages of all ceramic restorations are the esthetic characteristics, the biocompatibility and durability. They also show increased abrasion resistance, color and contour stability, appropriate translucency and excellent tissue response due to minimal plaque accumulation[5,6].

On the other hand, to achieve an esthetic result extensive tooth preparation is required that might lead to endodontic therapy, increased cost and time- consuming laboratory procedures. Furthermore, some common complications such as cracking, chipping and the fracture of the veneering porcelain material cannot be excluded.[5,6,7]

The present literature review identified numerous clinical studies in which cohesive fracture of the veneer material is the main and most frequent fault.[8,9] Regarding the available literature and some short-term clinical trials, core fractures were noticeably rare reported in zirconia-based single crowns over 1 to 3 years of follow up, while the veneer fracture proportion ranged from 0% to 15%.[10,11] The incidence of chipping on zirconia based fixed restorations has been reported ranging from 0% to 4% in clinical studies with 20 to 60 months follow-up [12-14]

Poggio et al [13] in a retrospective clinical study evaluated the clinical success and survival of porcelain veneered-zirconia based crowns fabricated with knife-edge margins. In this retrospective evaluation, feldspathic porcelain veneered-zirconia based crowns with knife-edge margins provided clinical performance similar to that reported with other margin designs. The knife edge margins examined in these studies 12-13 were similar to the margins of shell crowns used in the presented case.

In a retrospective study [15] the clinical performance of zirconia based fixed partial dentures (FPDs) with chamfer or knife edge preparations was evaluated over a period of 5 years. The estimated cumulative survival of all restorations was 94.70% $\pm$ 1.25%. Mechanical failures and problems occurred in low frequency

and were attributed to parafunction but were not correlated to the preparation type.

Although there are long term results from numerous clinical trials on the clinical performance of all ceramic restorations, there is no direct comparison (in-vitro or in-vivo) comparing chamfer with knife edge preparations. More detailed clinical data focused on the longevity of shell crowns are needed in order to adopt this treatment option as a standard clinical procedure.

Conflict Of Interest:

The authors report no conflicts of interest to any of the referred or used materials.

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