

CAD-CAM all-ceramic fully sintered zirconia crowns for the oral rehabilitation of an amelogenesis imperfecta case

Coroas CAD-CAM de zircônia totalmente sinterizada para reabilitação oral de um caso de *amelogenesis imperfecta*

Abstract

Purpose: To present a case report of a patient with *amelogenesis imperfecta* rehabilitated with 26 CAD-CAM all-ceramic fully sintered zirconia crowns.

Case description: A male subject, 28 year-old, sought dental treatment presenting a clinical condition compatible with *amelogenesis imperfecta*. All teeth had yellow, brown, and white areas of weak enamel. Composite restorations were present on teeth 14, 16, 24, 25, 26, 27, and 46; dental caries were shown on teeth 36, 37, and 47. Hypersensitivity was reported. The treatment included fully sintered zirconia crowns for all teeth, using a CAD-CAM system. No problems of marginal adaptation of the crowns were detected, and the final results were satisfactory for both the patient and the clinician.

Conclusion: The clinical rehabilitation of an *amelogenesis imperfecta* case is a challenge, and a multidisciplinary approach is required. Zirconia all-ceramics crowns are an excellent option to restore dental aesthetics as the opaque zirconia coping can mask dischromic abutments, and the crowns have biocompatibility and improved physical properties.

Key words: Crowns; amelogenesis imperfect; yttria-stabilized tetragonal zirconia polycrystals ceramic; dental esthetics

Resumo

Objetivo: Apresentar o caso clínico de um paciente com *amelogenesis imperfecta*, que foi reabilitado com 26 coroas CAD-CAM de zircônia totalmente sinterizada.

Descrição do caso: Um sujeito do sexo masculino, 28 anos, procurou tratamento odontológico apresentando uma condição clínica compatível com *amelogenesis imperfecta*. Todos os dentes tinham áreas amarelas, marrons e brancas de esmalte enfraquecido. Havia restaurações de resina composta nos dentes 14, 16, 24, 25, 26, 27 e 46; cárie dentária estava presente nos dentes 36, 37 e 47. Relatou-se hipersensibilidade dentária. O tratamento incluiu coroas de zircônia totalmente sinterizada para todos os dentes, usando um sistema CAD-CAM. Nenhum problema de adaptação marginal das coroas foi detectado e os resultados finais foram satisfatórios para ambos o paciente e o clínico.

Conclusão: A reabilitação clínica de *amelogenesis imperfecta* é um desafio e a abordagem multidisciplinar deve ser mandatória. As coroas de zircônia são uma excelente opção para a reabilitação de pacientes com esta anomalia, pois o opaco dos copings de zircônia pode mascarar as diferentes cores dos pilares e o resultado final é esteticamente aceitável, com biocompatibilidade e propriedades físicas superiores.

Palavras-chave: Amelogenesis imperfecta; coroas; cerâmica de policristais de zircônia tetragonal estabilizada pelo ítrio; estética dentária

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Introduction

Amelogenesis imperfecta comprises a unique group of hereditary alterations that result in abnormal enamel development. Teeth are more prone to wear and breakage, resulting in unsatisfactory esthetics, dental sensitivity, and loss of vertical dimension, which frequently requires extensive dental treatment (1,2). The oral rehabilitation of this pathology poses a clinical challenge for practitioners, and a multidisciplinary approach is often mandatory. While dental genetics rules the definite diagnosis, dental rehabilitation may include conservative procedures, such as direct restorations, or may evolve to Fixed Prosthodontics and occlusal treatment to achieve results with good esthetics and function.

New dental ceramics have been increasingly used for all-ceramic crowns and fixed partial dentures. Zirconia is an excellent ceramic material with mechanical properties similar to those of noble and base-metal alloys used for cast restorations; for this reason zirconia is sometimes named as “ceramic steel” (3). Fully sintered zirconia may reach flexural strength values as high as 1,200 MPa, and a 1:1 accuracy is achieved as sinterization contraction does not exist. However, the fabrication of restorations in fully sintered zirconia is time consuming and complex in the laboratory, thus partial sintered zirconia is more used (3-5). Also, zirconia is biocompatible, promotes low bacteria adhesion, has colors similar to natural teeth, and it is opaque, which is desirable to treat dischromic teeth (3,5), such as those found in cases of *amelogenesis imperfecta*.

Case Description

A male, 28 year-old patient sought dental treatment at the Fixed Prosthodontics Clinics of the Faculty of Dental Medicine of the University of Porto, Portugal, presenting a clinical condition compatible with *amelogenesis imperfecta*. At clinical examination, all teeth had yellow, brown, and white areas characteristic of weakened enamel. Composite restorations were present on teeth 14, 16, 24, 25, 26, 27, and 46; dental caries were present on teeth 36, 37, and 47. Hypersensitivity also was reported (Fig. 1).

The treatment planning included fully sintered zirconia crowns for all teeth to protect dental structure, reduce sensitivity, and improve esthetics and masticatory function. The patient had bad oral hygiene, and a plaque control program also was established. All treatment procedures were performed by dental students under clinical faculty supervision.

First and Second Appointments

Teeth 17-27 and 36-46 were prepared for full ceramic crowns with a shoulder finish line during two dental appointments. Provisional crowns (Tab 2000; Kerr Italia SpA, Salerno, Italy) were cemented with a temporary cement (Temp-Bond® Kerr España®, Spain) (Fig. 2).

Third Appointment

Dental impressions were made with a polyvinylsiloxane material (putty and light material, Express® 3M, USA) using a double-mix single step technique. A gypsum model (Kavo Everest Rock® Kavo, Germany) with individual dies was created.

Dental Faculty Lab Work

Every single tooth was scanned in a CAD-CAM scanning unit (Kavo Everest® Scan Control 4.07.06, Kavo, Germany). In the virtual model obtained the dental technician designed zirconia copings using the Kavo Everest® CAD software (v. 4.07.06) with the following dimensions: 0.55 mm of thickness (B), 0.3 mm in the marginal line (A), and 0.5 mm in the transition area (X). The designed copings were milled in a CAM unit (Kavo Everest®) using fully sintered zirconia blocks (ZH blanks® Kavo Everest, Germany) (Fig. 3).

Fourth Appointment

All copings were tested to check their adaptation to the respective abutments, and no marginal gaps were detected (Fig. 4). Although a plaque control program was established, the patient still had generalized gingivitis.

Fifth Appointment

Fully sintered zirconia copings were veneered and the obtained crowns were tested and cemented over the abutments with a resin cement (RelyX™ Unicem Self-Adhesive Universal Resin Cement® 3M, USA). Final results were satisfactory in relation to esthetics and function (Fig. 5, 6).

Discussion

The present dental literature is scarce in relation to clinical reports of fully sintered zirconia copings. Although the flexural strength values are higher than that of partially sintered zirconia, this type of work is very time and material (burs) consuming for the dental laboratory, and a robust machining system is necessary (7). It is expected a machining time of 8 hours per 4 units, which totalized 52 h for the present case. Additionally, the efficacy of the milling burs is reduced every 2 to 3 single units processing, and frequent replacement is needed. The main advantage of this type of ceramic block is that a 1:1 accuracy is obtained with the machining procedure, since the ceramic is already sintered, which improves crown adaptation. However, some previous studies (4,5) reported that pre-sintered zirconia blocks may be an alternative option for this type of complete oral rehabilitation with less laboratory work in relation to the time and materials consumed. Also, a recent review by Denry and Kelly (6) highlighted that some questions still remain about the zirconia surface topography after hard machining, while soft machining would provide better final results.

At the end of the treatment, function and esthetics were improved, and the patient was satisfied. An optimum result could not be achieved due to the fact that the patient

still had gingivitis, despite the established plaque control program and placement of provisional restorations over two endodontic treated teeth (37 and 47). According to Macedo (7), *amelogenesis imperfecta* may be associated with generalized gingival enlargement, although this finding is unusual. The patient with *amelogenesis imperfecta* can be treated with direct composite restorations, but clinical cases presenting large and generalized loss of dental structure would benefited from complete oral rehabilitation with fixed prostheses (1,8-10), specially all-ceramics crowns (8), which

may provide good esthetics, biocompatibility, and improved physical properties for several years.

In conclusion, zirconia crowns are an excellent option for the rehabilitation of patients with *amelogenesis imperfecta*. The opaque feature of the zirconia coping masks the dischromic abutments, and the final results are esthetically acceptable. Furthermore, the CAD-CAM fully sintered zirconia had no problems concerning marginal adaptation of the crowns, but the laboratory procedures are more complex than that of pre-sintered zirconia.



Fig. 1. Patient's initial condition: *amelogenesis imperfecta*, and gingivitis due a poor oral hygiene.



Fig. 2. Preparation of teeth 17-12, 22-27, 33-36 and 43-46, in the first appointment.



Fig. 3. Zirconia milled copings in the abutment models.



Fig. 4. Copings placed over the abutments. Patient had deficient plaque control with associated gingivitis.



Fig. 5. Full ceramic crowns (veneered fully sintered zirconia copings).



Fig. 6. Final result of the zirconia crowns cemented (front view and panoramic x-ray)

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