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Case Report

Aesthetics and Precision: A Case Report on Indirect Ceramic Restorations

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Abstract

From a restorative point of view there are many options to restore cavities with extended coronal distruction such as: direct, semi-direct, indirect resin-based procedures and indirect ceramic restorations. As digital dentistry became more prevalent, indirect ceramic restorations is the treatment choice for such situations. To illustrate this, we present a case report where two large cavities on posterior teeth have been restored using digital impression and ceramic restorations.

Keywords: Indirect Ceramic Restorations; Digital Impression; Aesthetics Function; Digital Dentistry

Introduction

The technological expansion of recent decades across all fields globally has triggered to the development of new techniques and protocols in dental medicine. In this context, the evolution of materials and adhesive systems had a significant impact on indirect restorations of posterior teeth, leading to important changes in treatment planning.

Partial restorations of posterior teeth allow for the preservation of the remaining dental structure, increase the tooth's resistance to fracture, and restore masticatory, phonetic, and aesthetic functions. These restorations can be classified as inlays (it has no cuspal protection), onlays (it covers at least one cusp) and overlays (it covers all the cusp) [1,2].

Ceramic inlays were first introduced in the late 1880's but because of their failure rate and difficulties in manufacturing, the did not become popular [3]. In 1835, John Murphy from London crafted the first porcelain inlay. The ceramic inlay preceded the metallic inlay. In 1880, Ames and Swasery used polished foil for inlay fabrication, a technique employed until the first decade of the 20th century. In 1897, the first cast inlay was introduced, a

breakthrough attributed to Philbrook. This innovative technique was later presented to the Iowa State Dental Society, marking a significant milestone in restorative dentistry. Although Taggart introduced the lost-wax technique in 1907 [4], the popularity of restoration grew thanks to contributions from Lane, Van Horn, Weinstein, Sonder, Schew, and Hollenback, who introduced new materials and techniques [5].

Even though resin-based composite materials have been used for many years to restore cavities with extended coronal distruction, the interproximal contact of these kind of restorations can deteriorate over time because of high occlusal wear. Besides this, the polymerization shrinkage, which is dependent of the location and depth of the restoration, is an additional disadvantage [6]. To overcome some of the disadvantages of the resin-based direct composite materials, restorations obtained through CAD/CAM (computer-aided design and computer-aided manufacturing) technology provide an ideal occlusal morphology and proximal contouring when restoring decayed posterior teeth [7,8].

In this article is presented a clinical case of two direct composite restoration replaced by two indirect lithium-disilicate CAD-CAM ceramic restorations (IPS E Max CAD, IvoclarVivadent), on vital teeth.

Clinical Case Report

A healthy 36-year-old woman visited the dental clinic, complaining of dental sensitivity to thermal stimuli and expressing dissatisfaction with the aesthetics of restorations in quadrants III and IV.

Following clinical and complementary examinations, fractured and poorly adapted restorations were observed on teeth 3.6 and 4.6, with deficient contact points (Figure 1, 2).

The recommended treatment plan was to replace the existing restorations with highly aesthetic, well-adapted, and durable ones. A written informed consent has been provided by the patient accepting the treatment plan and approving the publication of all the case details and any accompanying pictures.

Figure 1: Initial aspect of the lower arch – lingual view.

Figure 2: Initial aspect in maximum intercuspation – vestibular view.

Based on the clinical examination and complementary tests, the recommended treatment plan involved ceramic indirect restorations for teeth 3.6 and 4.6. After determining the color of the future restorations, the old fillings were removed along with the altered dentin, in accordance with general preparation design rules: ensuring the axis of insertion, defining preparation margins clearly – creating a threshold for proper marginal seal, ensuring preparation margins are at least 0.5–1 mm away from the occlusal stop.

The next step involved retracting the gingival sulcus to properly finish the cervical margins (Figure 3).

Figure 3: Prepared teeth aspect – lingual view.

For impressions, the intraoral scanning (IOS) method was chosen using the MEDIT i500 scanner. The scanning began with the occlusal surfaces of the lateral teeth for both arches, followed by the scanning of all other dental surfaces according to the manufacturer's recommendations. After recording the arches, the dental occlusion was registered bilaterally (Figure 4 - 11).

Figure 4: Mandibular impression – occlusal view.

Figure 5: Mandibular impression – oblique occlusal view.

Figure 6: Mandibular impression – oblique occlusal view.

Figure 7: Registration of dental arches in maximum intercuspation – lateral view, right side.

Figure 8: Registration of dental arches in maximum intercuspation – lateral view, left side.

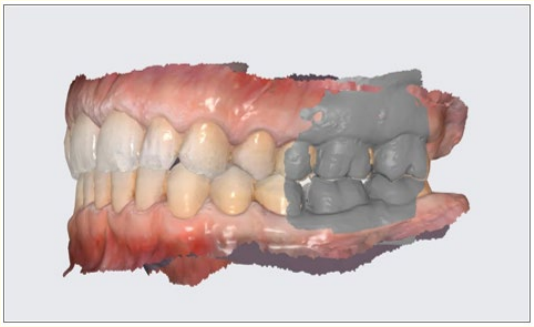

Figure 9: Registration of intermaxillary occlusal relationship, left side – lateral view.

Figure 10: Registration of intermaxillary occlusal relationship, right side – lateral view.

Figure 11: Bilateral registration of intermaxillary occlusal relationship – frontal view.

The information obtained via IOS was electronically sent to the dental laboratory, along with a digital restoration order form. The monochrome 3D files were imported into specific design software by the dental technician, who began designing the prosthetic restorations.

Until the final restorations were definitively cemented, the patient received a temporary restoration made of light-curable monofilament composite material. To provisionally protect such cavities, a material that can be easily removed without rotary instruments is recommended to prevent altering the preparation design, which could lead to inadequate adaptation of the prosthetic restorations (Figure 12).

Figure 12: The appearance of the temporary restorations.

The final clinical step is cementing the ceramic restorations (IPS E Max CAD, IvoclarVivadent) into the oral cavity using Variolink Esthetic DC (IvoclarVivadent). The cement choice was based on the thickness and color of the restorations (Figure 13, Figure 14, Figure 15, Figure 16).

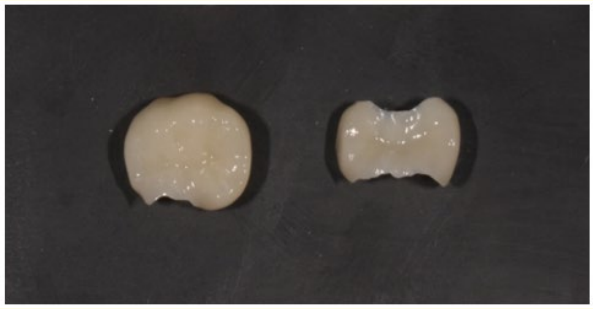

Figure 13: Pre-cementation aspect of indirect restorations.

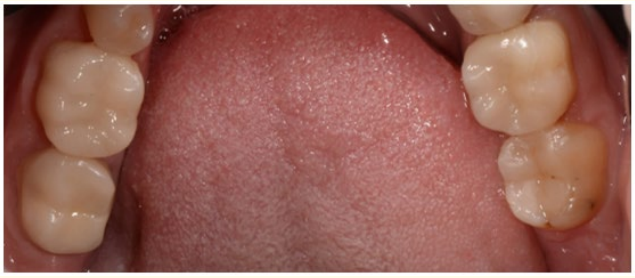

Figure 14: Post-cementation aspect of final restorations – occlusal view.

Figure 15: Post-cementation aspect of final restorations in maximum intercuspation – lateral view, right side.

Figure 16: Post-cementation aspect of final restorations in maximum intercuspation – lateral view, left side.

Discussions

Indirect restorations require precision throughout all clinical and technical phases. Any error, from cavity preparation to cementation, can lead to treatment failure. It is essential for prosthetic work to ensure marginal adaptation [9] and precision at the dento-prosthetic interface.

The continuous advancement of indirect restorations, in terms of adhesion and strength, has made this rehabilitation method a preferred and successful option in modern therapeutic arsenals [10,11]. This progress is due to the development of ceramic systems, both in structure and micromechanical adhesion, and acid etching between the adjacent dental structure and restoration, integrating these elements into a unified, modern, next-generation therapeutic approach [12].

In this case report, the treatment proposed to the patient offered greater comfort due to digital impression, ideal contact points, restored masticatory and aesthetic functions, being the most satisfactory option. Many studies in the literature have demonstrated that indirect ceramic restorations are the first treatment choice for cavities with extended coronal destruction [13-15].

Even though, direct restorations for posterior teeth are still widely used in dentistry, indirect restorations offer improved marginal adaptation, as concluded by Santos., *et al*. [16] and enable reduced polymerization shrinkage and better anatomy [17].

The choice between direct or indirect restorations depends on many factors including the extent of the cavity, aesthetic considerations or financial reasons. Direct restorations, typically made with composite materials, are preferred by clinicians due to their simple application, speed, low cost, and ability to preserve as much dental tissue as possible [18]. Indirect restorations with ceramic materials provide superior results in terms of translucency and color stability. Although they are initially more expensive, they have proven to be more cost-effective in the long term due to their durability and low maintenance requirements [19].

Digital technology has significantly advanced restorative dentistry, but this came with some limitations and challenges.

Equipment like intraoral scanners, milling machines, and 3D printers require significant investment. Maintenance and software updates add to ongoing costs, making it less accessible for smaller practices. Dentists and dental technicians need specialized training to use digital technology effectively. Regarding technical errors, scanners may struggle with capturing subgingival margins or deep periodontal pockets and intraoral scanning accuracy can be affected by factors such as saliva, blood, or patient movement. It is true that some patients may prefer traditional methods due to cost or unfamiliarity with new technology [20,21].

Future research in indirect ceramic restorations shoul be focused on their clinical performance, expanding their apllications, and adressing current limitations. Among these it can be mentioned: materials that can integrate biologically with dental tissues, promoting remineralization or even antimicrobial effects, standardazing techniques for reliable adhesion across various ceramic substrates or further exploring how indirect ceramic restorations interacts with human tissues over extended periods of time.

Conclusions

The evolution of digital dentistry, adhesive systems and materials has grown the clinician's interest for indirect posterior restorations. This case report emphasizes the multiple advantages of digital dentistry with the optical impressions and indirect restorations. This stage facilitates and simplifies the process for both the patient and the dental team, significantly reducing the time between preparation, impression taking and the completion of the prosthetic work. This procedure enhances communication between doctor and patient through the visual component and the digitization of the oral cavity, strengthening their collaboration.

For a better success rate and longevity of indirect ceramic restorations, respecting the indications, choosing the right adhesive and the form of preparation, are the key points.

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