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Application of Cantilever Resin-Bonded Bridges in Young Patients: A Clinical Case Perspective

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Abstract:- The challenge faced by dental surgeons with a single missing anterior tooth is multifaceted, particularly in achieving functional, aesthetic, and biological integration. This challenge becomes more pronounced in adolescents or young adults, where the passive eruption of the tooth is still active, necessitating the postponement of implant placement.
As either a temporary or long-term solution, a fixed prosthesis can be considered. However, in the current era emphasizing maximum tissue preservation, dental practices are increasingly leaning towards a benign and conservative prosthetic approach known as the "cantilever bonded bridge." This approach is specifically indicated for the replacement of central or lateral maxillary incisors and mandibular incisors, demanding adherence to a meticulous and stringent clinical protocol.

This article delves into a simplified clinical realization of the ceramic cantilever bridge. The utilization of cantilever bonded bridges, particularly those with a single retainer, emerges as a compelling alternative in comparison to various other therapeutic options.

Keywords:- *Adhesive Bridge, Cantilever, Minimally Invasive, Bonding, Ceramic, Lateral Incisors, Anterior Single-Tooth, Edentulous.*

I. INTRODUCTION

Restoring a missing front tooth poses a significant challenge for dental surgeons, requiring the restoration of both function and aesthetics, particularly in young individuals where implant treatment must be deferred until adulthood. Preferred treatment options include fixed prosthesis restoration, such as a conventional bridge or a resin-bonded bridge (metallic resin-bonded bridge or ceramic resin-bonded bridge). (1)

With advancements in bonding adhesives and a growing emphasis on tissue preservation, the cantilever bonded bridge has emerged as a viable solution in modern dentistry. This evolution in dental practices reflects a shift towards techniques that prioritize both functional and aesthetic outcomes, especially in cases involving the anterior teeth. (2,3)

The use of adhesive bridges is not new, but their design, structure, and assembly biomaterials have undergone significant evolution. Several authors have demonstrated, initially on metal frameworks and later on ceramic frameworks, the possibility of bonding a single retainer onto a pillar, solidified at the intermediary. The therapeutic approach in the case of a single anterior edentulous space remains a challenging task despite various prosthetic possibilities. However, the ceramic cantilever-bonded bridge represents a particularly appealing biological and biomechanical alternative. Undoubtedly, it signifies an evolution of the adhesive bridge that practitioners should incorporate into their therapeutic repertoire. (2,4)

This article aims to describe the advantages, indications, clinical performance, and procedural steps involved in the fabrication of these ceramic cantilever-bonded bridges in the anterior region through a clinical case conducted at Farhat Hached Hospital in Sousse in Tunisia.

II. CASE STUDY

A 15-year-old male, in good overall health, sought consultation at Farhat Hached Hospital in Sousse, Tunisia, in January 2022 for the replacement of his left maxillary central incisors (tooth 21), which had been extracted following a traffic accident one year prior. A transparent Essix retainer was used as a temporary retention solution. The patient expressed a desire to address his anterior edentulism through a fixed therapeutic approach.

A. Clinical Examination:

The extraoral examination revealed no anomalies. Intraorally, oral hygiene was considered average, and the periodontal phenotype exhibited thickness.

Examination of the spaces in the position of tooth 21 revealed sufficient mesio-distal width for the placement of a permanent central incisor. The height of the prosthetic space was measured at 4 mm.

Examination of the teeth adjacent to the edentulous space, specifically the central incisor (tooth 11) and lateral incisor (tooth 22), indicated their health and normal position. All had a relatively low Le Huche index, and the bonding surfaces on tooth 11 were deemed satisfactory. Fig. [1]

Fig. 1: Initial situation at the consultation

B. Occlusal Examination :

The maximal intercuspidation occlusion (MIO) is stable, exhibiting a Class I relationship for canines and molars. It is noteworthy that there is a 2mm overjet . Fig. [2]

During protrusion, functional anterior guidance is observed. In left and right lateral movements, there is canine guidance. No signs of iatrogenic occlusal wear or parafunction are evident.

Study casts transferred to an articulator confirmed the anatomomorphological data observed during the intraoral clinical examination and finalized the occlusal assessment.

Fig. 2: Patient's occlusion in maximum intercuspation position

C. Radiographic Examination:

Dense bone is visible in the edentulous area, indicating a highly satisfactory anchorage of the adjacent teeth at the sites of teeth 11 and 22. They exhibit a favorable radiographic crown-to-root ratio, with a value less than 1.

D. Therapeutic Decision:

Due to the patient's age (<18 years), implant therapy is ruled out. Adhering to the principle of tissue economy, the chosen therapeutic solution is a resin-bonded bridge.

The decision is to proceed with the fabrication of a cantilever bridge using e.max® glass-ceramic (Ivoclar), featuring a retainer on tooth 11 with extension to tooth 21.

E. Clinical Steps:

- *Preparation of Central Incisor:*

We performed enamel preparations on the palatal surfaces of tooth 11. The inter-arch space obtained facilitates the easy insertion of the resin-bonded bridge. Fig. [3]

Fig. 3: Palatal preparation of tooth 11

A digital impression was obtained using intraoral scanning in the same session to record the prepared tooth, the surrounding periodontal tissues, adjacent teeth, and the patient's occlusion. Fig. [4-5]

Fig. 4: Digital impression of the maxillary arch

Fig. 5: Digital recording of occlusion.

- *Shade Selection*

The shade selection was performed under natural light. The patient has teeth that are not very clear and luminous. We opted for the 2M2 basic shade (3D Master shade guide).

- *Material Selection for Restorations:*

Considering the brightness of the patient's teeth, we once again chose IPS e.max® (Ivoclar Vivadent). This is a lithium disilicate-reinforced glass-ceramic, chosen for its aesthetic properties, biocompatibility, and natural appearance in pressed technique. Fig. [6]

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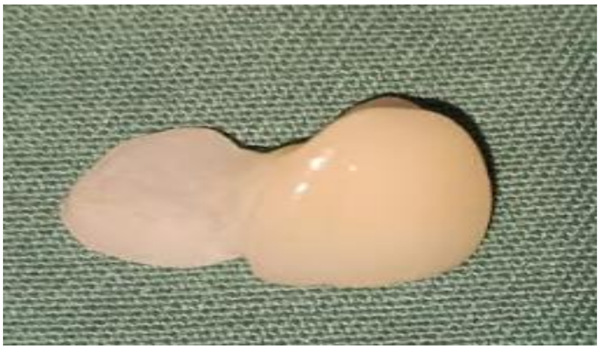

Fig. 6: Completed Cantilever Resin-Bonded Bridge

➢ *Fitting:*

During the fitting of the cantilever resin-bonded bridge, we verify the adaptation of the bridge first on the model and then in the mouth.

We also check the emergence profile at the level of the cervical and free edge, the color of the prosthesis, and the dimensions and shape of the pontic in extension. Fig. [7-8-9].

Fig. 7: Vestibular View of the Bridge on the Working Model

Fig. 8: Palatal View of the Bridge on the Model

Fig. 9: In-Mouth Fitting of the Cantilever Bridge

➢ *Bonding Process:*

Starting with the preparation of dental surfaces, a photopolymerizable rubber dam was used to isolate the operative field. This type of dam is less burdensome for the patient than the traditional rubber dam placement. Subsequently, the palatal surfaces of the central incisors underwent acid etching with orthophosphoric acid, followed by rinsing and the application of adhesive, which requires photopolymerization. Fig. [10]

Fig. 10: Photopolymerization of the applied adhesive on the tooth.

Then, the prosthesis surfaces were prepared through etching with hydrofluoric acid, followed by the application of silane. Fig. [11].

Fig. 11: Application of hydrofluoric acid on the bridge, specifically on the intrados

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Then, the actual bonding process must be carried out. Care must be taken to ensure the proper positioning of the bridge in the mouth. Once polymerization is complete, we proceed to the finishing steps. Polishing and finishing procedures were performed to achieve optimal aesthetics and smooth surfaces. Fig. [12]

Fig. 12: Finishing step with polishing cups.

- *Final Result:*

After bonding, it is essential to check the patient's static and dynamic occlusion. The patient is satisfied with the result, providing a functional and aesthetically pleasing restoration. Fig. [13]

Fig. 13: Patient's smile view after bridge placement.

III. DISCUSSION

The evolution of bonded bridges has witnessed substantial changes in design and biomaterials. Originally crafted with metal frameworks, the transition to all-ceramic compositions marked a significant shift. [4-5].

The Rochette Bridge in 1970 initiated this evolution, followed by bridges with two perforated metal retainers and metal-resin bridges, emphasizing a minimally invasive approach without enamel preparation. However, these designs exhibited drawbacks such as plaque accumulation, limited biocompatibility, weakened metal support, and suboptimal adhesion. [7].

The introduction of the Maryland Bridge in 1982 aimed to address some issues by incorporating sandblasting-treated metal undersides for enhanced mechanical adhesion. Despite this, challenges like plaque accumulation, biocompatibility concerns, limited metal adhesion, and frequent detachment persisted. [8].

In the 2000s, the evolution continued with the introduction of Cantilever Resin-Bonded Bridges, characterized by a minimally invasive preparation technique involving lingual facet, cingulum groove, and small proximal box preparation according to Kern's principles. These advancements highlight an ongoing process of refining bonded bridge designs to address various challenges encountered throughout their development. [10-11].

This evolutionary design addresses aesthetic concerns, reduces the risk of caries, and improves biocompatibility, all while adhering to a minimally invasive approach with excellent bonding capabilities. Notably, the absence of a requirement for secondary retention devices is a significant advantage. [12].

Advocates for the utilization of Cantilever Resin-Bonded Bridges in clinical scenarios highlight six key benefits. First, they present an appealing therapeutic alternative, particularly for single-tooth gaps, challenging the perception of bonded bridges as temporary solutions. Second, the emphasis on tissue preservation aligns with contemporary conservative dentistry principles, requiring less tooth preparation and minimizing the risk of pulpal trauma. The ease of implementation, characterized by no mandatory anesthesia, a supragingival finishing line, quick preparation, simple impression, easy try-in, and straightforward bonding, allows for possible re-intervention when necessary. Patient comfort and satisfaction are enhanced through rapid implementation in a few sessions. From an economic perspective, health-economic studies demonstrate that bonded bridges, whether cantilever or multiple-support, exhibit excellent cost-effectiveness compared to traditional bridges and implants. Finally, the unique geometry of bonded bridges improves hygiene by enabling flossing under the pontic extension, coupled with a limited likelihood of partial debonding, reducing the risk of caries beneath the bridge a marked improvement over traditional bonded bridges. [13-14].

Bonded bridges are specifically indicated for clinical situations involving a single anterior tooth gap, located in the maxillary or mandibular incisor region, and are considered suitable for children and adolescents during the bone growth phase. The adjacent teeth condition should include nearly healthy teeth with reduced mobility and a favorable crown-to-root ratio radiographically. Although these indications align with clinically ideal scenarios for a single-unit implant-supported prosthesis, the preference for a bonded bridge over an implant may be influenced by factors like medical impossibility (inability to undergo implant placement due to conditions such as infective endocarditis), absolute contraindications to surgery (like graft rejection), economic considerations, and availability. [15-16].

Regarding the Longevity of Bonded Bridges, a 2012 systematic review by Kern et al. reported survival rates at 5 and 10 years of 73.9% and 67.3% for two-retainer bridges, whereas single-retainer bridges showed higher rates at 92.3% and 94.4%. Notably, studies, including those by Kern et al. and Botelho et al., demonstrated no statistically significant differences between the anterior maxillary and mandibular regions. [16-17].

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In terms of debonding risk, ceramic zirconia-based bridges encountered debonding across various investigations, mainly linked to traumatic events. Fractures were rare complications, primarily affecting ceramic infrastructure bridges, with reported fractures in glass-infiltrated alumina ceramics and no fractures observed in zirconia bridges. The occurrence of secondary caries was mentioned in one study, but the reported lesion was localized on the lingual surface of the abutment and not under the retentive retainer. Consequently, the cause of this carious lesion may not be directly related to the bonded cantilever but rather attributed to the patient's inadequate hygiene practices. [16-18].

IV. CONCLUSION

Addressing anterior edentulous poses two major challenges: achieving aesthetic integration and preserving biological structures. The cantilever bonded bridge meets these requirements and appears to be a subtle, contemporary, and realistic alternative to anterior implants. This is particularly relevant for adolescent or young adult subjects, where determining the precise end of growth is difficult or even illusory.

The advent of bonding, coupled with the continuous improvement of the mechanical and optical properties of lithium disilicate glass ceramics and their excellent adhesion potential, has made lithium disilicate-enriched ceramics a preferred material for creating anterior cantilever bonded bridges.

This Cantilever Resin-Bonded Bridge can now be viewed as a durable treatment, not just a temporary one. Its adaptability, either through replacement or the delayed placement of an implant at a later date, makes it the preferred first-line solution in the therapeutic arsenal for congenitally missing teeth.

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The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g.” Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

Conflict of Interest: Authors declare no conflict of interest.

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