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Aesthetic And Functional Treatment Of Missing Central Incisor With Lithium Disilicate Adhesive Bridge

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ABSTRACT

Loss of anterior teeth is associated with aesthetic, phonetic, and functional disturbances. Due to the lower chewing load on the anterior teeth compared to the posterior teeth, a fixed partial denture with a lithium disilicate adhesive bridge can be a good alternative and compromise in this case with minimal invasive preparation, because it has better adhesive system, retention, strength, and aesthetics compared to metal material. To guarantee a strong long-term bonding, it is mandatory to perform adhesive procedures on enamel. Therefore, careful attention must be paid to guarantee that all margins and the tooth restoration interphase remain within the thickness of sound enamel. This case report aims to describe adhesive bridge treatment using lithium disilicate in cases of missing central incisor teeth. A 25-year-old female patient came to Padjadjaran University Dental Hospital (RSGM) with a chief complained of fractured central incisor with only the remaining mobility root or radix due to a previous accident and it caused aesthetic concerns as her job requires frequent interaction. The patient wanted to use a fixed denture without significant reduction of the adjacent teeth. After the remaining root or radix was extracted, the patient was inserted with a fixed denture using an adhesive bridge made of lithium disilicate material. Use of adhesive bridge dentures with lithium disilicate material for maxillary anterior teeth and provided satisfaction for patients because it can overcome aesthetic problems and improved good phonetic and masticatory functions.

Keywords: Minimal invasive, Adhesive bridge, Lithium disilicate

INTRODUCTION

There are several treatment options available to treat missing anterior teeth. For prosthodontic treatment of the anterior part, it must be able to meet the demands from an aesthetic perspective while achieving good functional capabilities. Although removable acrylic dentures are often a treatment option, many patients do not accept them well and generally have the reasons for being

less comfortable and less aesthetic. Conventional bridges are a better choice, but are not a suitable choice for young patients, where young patients have large pulp chambers so there is a high possibility of damage to the pulp tissue during tooth preparation. Many adult patients also prefer not to cause damage or reduction to adjacent teeth.[1]

Anterior resin-bonded bridges are conservative as a choice of fixed partial denture (FPD) to replace missing anterior teeth.[2,3] This option is traditionally recognized as a short-term and medium-term solution in the field of anterior teeth due to its high technical complications.[4] However, advances in bonding systems and preparation designs have increased the survival rate of restorations.[5,6] Nowadays, these restorations are becoming a long-term treatment option.[4,5,7]. Implant treatment options can also be a good choice, but not all bone conditions can support it and it is also an expensive treatment and takes a long time. In young adult patients, adhesive bridges are a suitable choice because they are conservative and compromise for patients where the treatment is minimally invasive, and the procedure is simple. Many studies state that resin-bonded fixed prostheses, such as adhesive bridges, can provide satisfactory results with clinically acceptable survival rates.[1,8]

Adhesive bridges were introduced to the world of dentistry in the 1970s. Rochette in 1973 was the first to have a prosthesis design like this. The design includes holes in the metal frame of the retainer to increase retention. Initially, the goal of this prosthesis was to preserve periodontally compromised teeth. Its use eventually expanded to replace missing anterior teeth in young patients. One of the disadvantages of the Rochette perforated retainer is that the resin cement can dissolve, causing leaks under the retainer.[9,10]

In 1998, lithium disilicate was introduced as a dental restorative material. In principle, this system consists of two phases, phase I has homogeneously distributed lithium disilicate crystals (Li2O-SiO2) and lithium orthophosphate, while phase II is formed from a glass matrix.[11] The presence of these crystals in a high proportion of structures improves the mechanical properties of the material. However, the use of lithium disilicate in the posterior region is very limited due to its inadequate mechanical properties.

Therefore, zirconia-reinforced CAD systems are an option for posterior restoration.[12]

Furthermore, it has the potential to serve as a temporary replacement or transition tool for several years as other treatment options remain in the event of failure. However, any failed restoration should be critically evaluated to identify the factors that led to the failure to avoid them and optimally control these factors before administering further treatment. This will promote restoration with longevity, and at the same time, improve patient health, patient motivation, engagement with home care, and OHRQoL.[13] This case report aims to provide information that lithium disilicate material can be used in all ceramic adhesive bridges by considering its superior mechanical and aesthetic properties.

Case Report

A 25-year-old woman came to the Dental and Oral Hospital, Department of Prosthodontics, Padjadjaran University, Bandung with a complaint that her upper central incisor was missing and wanted to be replaced and felt that it disturbed her aesthetics because the patient's job required frequently meeting clients. The tooth was removed 2 months ago because the patient had an accident on the way to the office, so the tooth eventually became loose and broke. The patient has never had a history of wearing dentures and because of high aesthetic demands, the patient wants to use a fixed denture made from a material that most closely resembles natural teeth without experiencing much reduction in the adjacent teeth. The patient refused to use removable dentures. Adhesive bridge treatment with lithium disilicate material is the choice in this case because it has a good adhesive, retention, strength, and aesthetic system that meets the patient's wishes.

Figure 1. Extraoral Photos.

Extra oral examination showed an oval face, normal profile, normal lip consistency, normal mouth opening width, no enlarged lymph nodes, and no abnormalities in the jaw joints. For intra-oral examination, it was found that tooth 21 was missing. The fracture on tooth 21 had been removed ± 2 months ago due to looseness after the tooth was broken first due to an accident 6 months ago. Teeth 11 and 22 grow normally and can be used as ideal adhesive bridge support teeth.

Figure 2. Intraoral Photos.

Color A1 slightly to A2 with Ivoclar Vivodent shades guide as reference, selected using shade guide with left lateral incisor (22) and right central incisor (11) as reference. Minimally invasive preparation was carried out on the palatal surfaces of abutment teeth 11 and 22 using a deep chamfer diamond bur and smoothed with a finishing bur. The preparation forms a cingulum rest so that it can produce a retainer thickness of ±7mm. Preparation of the palatal part to a limit of 0.5 mm from the incisal line. After the preparation is complete, one-step printing is carried out using polyvinyl siloxane material (heavy and light body). Wax up is done digitally in the laboratory.

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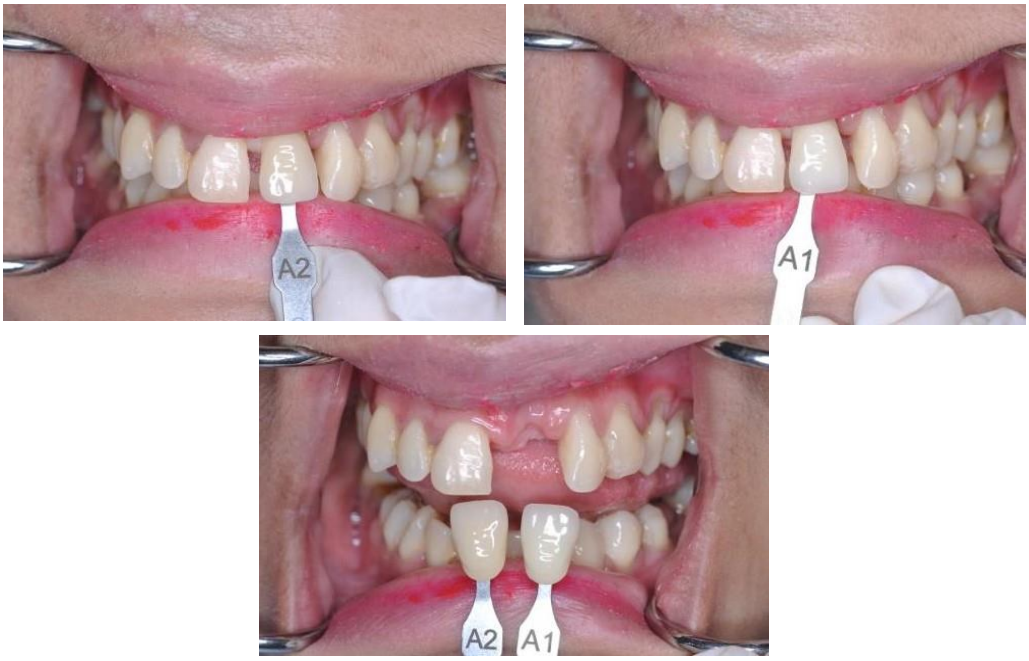

Figure 3. Selection of shade guide.

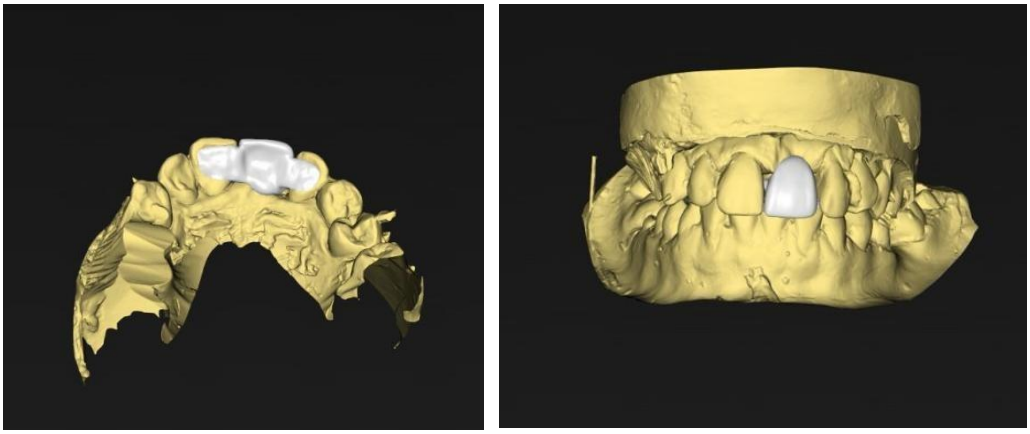

Figure 4. Digital wax up on a working model.

Lithium disilicate-based ceramic is the material used in this adhesive bridge case to achieve ideal aesthetic function. The adhesive bridge is manufactured with an Ivoclar Vivadent IPS e.max Press. The girdle retainer part was etched with 9% hydrofluoric acid and silane. 37% phosphoric acid etching was applied to the teeth, then rinsed with sterile water, dried, and cemented using

dual-cure resin cement. Completion of treatment resulted in a successful outcome both aesthetically and functionally. Follow-up was carried out on the patient after 1 week and 1 month, there were no complaints and the patient also felt very satisfied from the functional and aesthetic aspects.

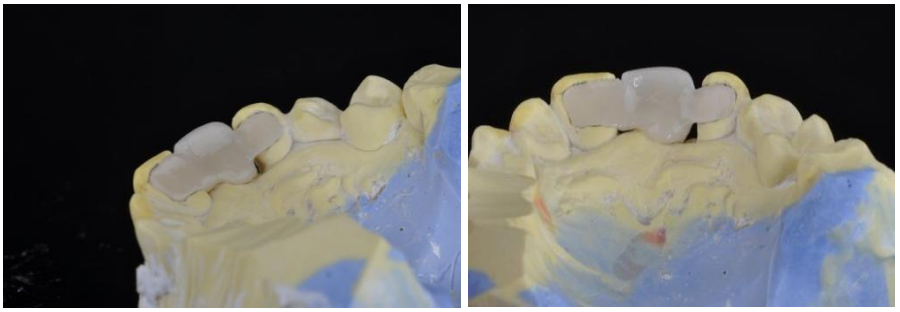

Figure 5. Adhesive bridge produced with the Ivoclar Vivadent IPS e.max Press.

Figure 6. Intraoral image of 1 week follow up of adhesive bridge installation.

Discussion

The survival rate of adhesive bridges is still much lower than conventional fixed partial dentures. The main reason for failure is the possibility of debonding of the frame/retainer from the abutment teeth. In the study of Audenino et al., in which cementation was performed with or without the use of a rubber dam, the

estimated survival rate probability of first debonding or failure, considering 100 cases, was 85% after five years. The use of rubber dam when attaching reduces the risk of debonding tenfold.[14] In a study, the success rate of an adhesive bridge with a retainer made of alumina ceramic infiltrated with glass was determined, observed for 10 years, the success rate was found to be 94.4%.[15] However, adhesive bridges are still more conservative compared to conventional bridge preparation where approximately 70% of the retainer tooth structure is expected to be removed at the preparation stage to receive a full-coverage retainer.[16]

With the introduction of newer and stronger ceramic and non-ceramic materials, the use of adhesive bridges with non-metallic frameworks has increased significantly. Glass ceramics, zirconia, lithium disilicate, and fiber reinforced composites have been used by clinicians to replace metal frameworks in resin-bonded fixed prostheses, classically known as Maryland bridges.[15,16,17] Chen et al in their review found that adhesive bridges with ceramic materials had an estimated 5-year survival rate of 91.2%.[18] However, there is still very little long-term data available for non-metal adhesive bridges compared to metal adhesive bridges.

There tends to be a higher success rate when the prosthesis design uses one retainer to support a single pontic rather than two retainers. One recent study published in 2016 compared adhesive bridges with metal framework using one retainer versus two retainers, finding an estimated five-year success rate of 100% for the group with one retainer and 75% for the group with two retainers. Eighty percent of the adhesive bridges in the group with two retainers underwent debonding.[2] Researchers compared anterior adhesive bridges with one retainer versus two retainers made from glass-infiltrated alumina ceramic (In-Ceram alumina) and reported success rates of 97.5% for the group with one retainer and 88.3% for the group with two retainers. The reason for failure in the group with two retainers in this study was due to framework cracking.[15]

Most of the studies used dual cure and chemical resin cements as cementation materials. Following the manufacturer's instructions correctly and selecting compatible materials are the most important factors in successful

cementation. Zirconia does not have a glass phase, making it a material that cannot be etched like metals and ceramics. As mentioned previously, there are two studies using zirconia frameworks. The adhesive bridge was attached using two different cementation materials and demonstrated a success rate of 90%, with two reported failures caused by debonding, one of which was due to trauma. The high strength of zirconia makes it more resistant to fracture compared to In-Ceram alumina ceramics. However, the difficulty in cementing zirconia on tooth structure requires extra caution in its use to create adhesive bridges, where retention of the prosthesis primarily depends on bonding to the enamel.[18]

One type of fixed denture and the development of materials and techniques for ceramic dentures, namely IPS E-Max Press. IPS E-Max Press is a versatile, metal-free and aesthetically pleasing material, providing excellent restorations. Other advantages of this material include a precise fit and almost perfect contact between adjacent and opposing teeth. The absence of shrinkage optimizes fit, making it suitable for anterior or posterior implants and crowns. With its versatility, long-term clinical success, and wide range of indications. The IPS e.max system is the most successful and widely used system for ceramics worldwide. IPS e.max Press is also a dental material that has advantages in terms of aesthetics which is available in ingot form. The shape of the ingot is more homogeneous so that it can improve the physical properties of the coping. In addition, IPS e.max Press has different translucency levels, with a strength of 400 Mpa and has accurate fittings. Ingots IPS e.max Press offers two types of ingots, namely polychromatic multi-ingots in one size and monochromatic ingots with five levels of translucency in two sizes. Polychromatic multi-ingots provide high aesthetics to a denture restoration and have A-D color shades and can be used for veneer restorations, anterior and posterior crowns. The manufacturing technique uses polychromatic ingots, namely the staining technique where the full contour of the wax-up is implanted and then pressed to complete the restoration until the staining and glazing burning stage.[19]

Along with the demands of the age of science and technology in the field of dentistry, especially in the field of cosmetic and aesthetic dentistry, known as Cosmetic Dentistry, is also developing rapidly. Losing teeth requires dentures to

restore aesthetics and function, which is one of the most important things for patients to come to the dentist for. Fixed partial dentures are artificial teeth that are permanently attached to the remaining teeth when one or more teeth are missing. According to research by Holm et al. in 2003, 53% of GTCs carried out by boarding school students at the Swedish Dental School could even last up to 30 years.[20]

Conclusion

Conservative treatment options should always be available and recommended as the treatment of choice when indicated, which can prevent limited options when one treatment fails. Adhesive bridges with lithium disilicate material for maxillary anterior teeth are a minimally invasive treatment option, which can provide patient satisfaction because it can overcome aesthetic problems and improve phonetic and masticatory function. All factors that contribute to restoration failure must be managed and addressed prior to undertaking further treatment.

References

1. Potdukhe S. All Ceramic Pressable Lithium Disilicate Maryland Bridge: A Case with Two-Year Follow-up. Journal of Clinical and Diagnostic Research. 2022.
2. Botelho MG, Chan AW, Leung NC, Lam WY.Long-term evaluation of cantilevered versus fixed-fixed resin-bonded fixed partial dentures for missing maxillary incisors. J Dent. 2016; 45:59-66.
3. Gulati JS, Tabiat-Pour S, Watkins S, Banerjee A. Resin-bonded bridges–the problem or the solution? Part 1: Assessment and design. Dent Update. 2016; 43(6):506-21.
4. Thoma DS, Sailer I, Ioannidis A, Zwahlen M, Makarov N, Pjetursson BE. A systematic review of the survival and complication rates of resin-bonded fixed dental prostheses after a mean observation period of at least 5 years. Clin Oral Implants Res. 2017; 28(11):1421-32
5. Abuzar M, Locke J, Burt G, Clausen G, Escobar K. Longevity of anterior

resin-bonded bridges: Survival rates of two tooth preparation designs. Aust Dent J. 2018; 63(3):279-84.

6. Balasubramanian GR. Predictability of resin bonded bridges - A systematic review. Br Dent J. 2017; 222(11):849-58
7. Alraheam IA, Ngoc CN, Wiesen CA, Donovan TE. Five-year success rate of resin bonded fixed partial dentures: A systematic review. J Esthet Restor Dent. 2019; 31(1):40-50.
8. Faris Y, der berghe V, Filiep R, Hugo De. A retrospective cohort study of metal-cast resin- bonded fixed dental prostheses after at least 16 years.Eur J Oral Implantol. 2013;6(1):1–10.
9. Pjetursson BE, Tan WC, Tan K, Brägger U, Zwahlen M, Lang NP. A systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least 5 years. Clin Oral ImplantsRes. 2008 Feb;19(2):131–41.
10. Rochette AL. Attachment of a splint to enamel of lower anterior teeth. J Prosthet Dent. 1973 Oct;30(4):418–23.
11. Denry I, Holloway J. Ceramics for Dental Applications: A Review.Materials. 2010 Jan 11;3(1):351–68.
12. Albakry M, Guazzato M, Vincent Swain M. Biaxial Flexural Strength and Microstructure Changes of Two Recycled Pressable Glass Ceramics. Journal of Prosthodontics. 2004 Sep 2;13(3):141–9.
13. Hin Beh Y, Ariffin A. Critical Evaluation of Failed Maxillary Resin Bonded: A Case Study. Journal of Dentistry Indonesia 2022;29. https://doi.org/10.14693/jdi.v29i2.1269.
14. Audenino G, Giannella G, Morello GM, Ceccarelli M, Carossa S, Bassi F. Resin-bonded fixed partial dentures: ten-year follow-up. Int J Prosthodont. 2006;19(1):22–3.
15. Sasse M, Kern M. CAD/CAM single retainer zirconia-ceramic resin-bonded fixed dental prostheses: clinical outcome after 5 years. Int J Comput Dent. 2013;16(2):109–18.
16. Alraheam IA, Ngoc CN, Wiesen CA, Donovan TE. Five-year success rateof resin-bonded fixed partial dentures: A systematic review. Journal of Esthetic

and Restorative Dentistry. 2019 Jan;31(1):40–50.

17. Sailer I, Bonani T, Brodbeck U, Hammerle C. Retrospective Clinical Studyof Single Retainer Cantilever Anterior and Posterior Glass-Ceramic Resin-Bonded Fixed Dental Prostheses at a Mean Follow-up of 6 Years. International Journal of Prosthodontics. 2013 Sep;26(5):443–50
18. Chen J, Cai H, Suo L, Xue Y, Wang J, Wan Q. A systematic review of the survival and complication rates of inlay-retained fixed dental prostheses. J Dent. 2017 Apr; 59:2–10.
19. Bekhiet, M., taymour, maha, & Zamzam, M. Clinical Evaluation and Patient Satisfaction of Shade Matching Between Natural Teeth and Monolithic All-Ceramic Crowns Fabricated from Two Materials (Randomized Controlled Clinical Trial). Egyptian Dental Journal. 2021. 67(3), 2231–2238. https://doi.org/10.21608/edj.2021.62512.1495.
20. Handoko, S. A. Laporan Kasus Pembongkaran Gigi Tiruan Cekat (GTC) Pasca Kegagalan Perawatann Perawatan. 2018.