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Review

An Overview of Maryland Bridges and their Clinical Applications

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Abstract

Resin bonded bridges are fixed prostheses that require little to no surgery and are held in place by composite resin cements. The "Maryland" bridge, which was made possible by the invention of the electrolytical etching method for nickel-chrome alloys, enabled the resin cement to undergo micromechanical adhesion to the metal surface. Their major advantage is that they require minimal, or at best, no tooth preparation. The preparation is usually kept within enamel which eliminates the need for local anesthesia during tooth preparation. When care is taken to maintain the margins of the Maryland bridges supragingivally, periodontal health is preserved. An additional advantage of the Maryland bridges is that in the event that a wing debonds, it is possible to rebond it after merely cleansing the wing and tooth. The most frequent issues with resin-bonded prostheses including debonding are cavities and three-tooth discoloration. There are two alternatives if a bridge debonds: rebonding or remaking. Replacing the bridge has been proven to have a greater success rate. During the assessment phase, any deleterious behaviors should be discovered, and the individual should be advised to stop doing things like biting their nails or pens. They offer an alternative to traditional bridgework10 or implants for restoring lost teeth, and because they typically don't require local anesthesia, individuals who are afraid of needles or don't want to undergo extensive surgery can have the operation. Maryland bridges are a choice in situations where there might not be enough bone or three-dimensional space for implant implantation. Patients also prefer smaller sessions because of the cost savings compared to traditional bridgework and implant-supported restorations. These prostheses should be considered as a restorative choice for short time periods and those desiring minimal chair time given complete patient evaluation and the application of appropriate therapeutic procedures.

Keywords: *resin bonded bridge, Maryland bridge, interim prosthesis*

Introduction

Resin bonded or resin retained bridges (RBBs/RRBs) are fixed prostheses that require little to no surgery and are held in place by composite resin cements. These had perforations to allow macro-mechanical retention between the resin and metal framework, and they were joined by autopolymerizing acrylic resin to enamel that had been acid-etched (1). They were created to splint periodontally compromised teeth with mobility and be maintained using metallic wings. After the success of this method, the splint was changed into the "Rochette" bridge, which involved employing wings with perforations on the palatal or lingual surfaces of both adjacent teeth to attach a pontic to them (2). The primary drawback of traditional fixed partial dentures is the need to remove dental tissue in order to prepare the abutment for the retention devices. The resin-bonded fixed partial denture is a substitute for traditional fixed partial dentures, which simply need the abutments to be lightly prepared (3). For the replacement of a single lost tooth, there are numerous treatment options, including dental implants, fixed partial dentures, and removable partial dentures. Each modality is a potential therapy and has benefits and drawbacks of its own. The decision-making process for patients requires that they understand the benefits and drawbacks of different therapeutic techniques. For this reason, replacing missing teeth is one of the two restorations in dentistry that present the greatest challenges. The Rochette design had a flaw in that the perforations in the wings would cause the wearing of the resin usually result in bridge debonding. According to a different view, since composite resin is not recognized for having severe wear behavior, the stress that is formed around the rivets may actually be a more important factor in the material loss (1). When nickel-chrome alloys could be electrolytically etched, this issue was solved in the early 1980s (4, 5). The "Maryland" bridge, which was made possible by this method, enabled the resin cement to undergo micromechanical adhesion to the metal surface (6). 3.5% nitric acid is used for electrolytic etching at 250 mA current for 5 minutes, following which the appliance is placed for 10 minutes in an ultrasonic cleaner with 18% hydrochloric acid. For nickel-chromium alloys without beryllium, use this approach; for beryllium-containing nickel-chromium alloys, use a 10% solution of sulfuric acid at 300 mA current, proceeded by the identical process as above (7). Posterior bridges were the first of this type. The requirement to etch the retainer surface was eliminated owing to new advancements in resin bonding agents, which made it possible to create a chemical link between the resin cement and the grit-blasted oxidized retention surface (8). The RBB is currently a popular technique for restoring lost teeth. The purpose of this paper is to evaluate the literature and go over how RBBs are currently being used in dental settings.

Methodology

This study is based on a comprehensive literature search conducted on October 8, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about Maryland bridges and their clinical applications. There were no restrictions on date, language, participant age, or type of publication.

Discussion

The major advantage of the RBB is that it requires minimal, or at best, no tooth preparation. It is therefore, by definition, a conservative method of replacing a missing tooth. Although there is currently debate as to the required amount of preparation, most authors agree that if done, the preparation should be kept within enamel. Hence, the requirement for local anesthesia during tooth preparation is often said to be negated. Recent research, however, has shown that even when it is the intention of the operator to keep the preparation minimal, some dentin is usually exposed (9). This can obviously affect the need for local anesthetic and reduce subsequent bond strengths. The RBB becomes a reversible treatment modality if preparation is kept to a minimum or avoided altogether because no "biological harm" is caused. As there has been conflicting data about the impact of RBBs on periodontal health, care should be taken to maintain the margins of the RBB supragingivally, due to evident benefits to the periodontal tissues. While other studies (10, 11) have reported elevations in plaque index, probing depth, gingival inflammation, and loss of attachment, one study (12) suggested no negative impact on periodontal health. After 10 years of use, though, it is claimed that the clinical findings were found to be insignificant (10). An additional advantage of the RBB is that in the event that

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a wing debonds, it is possible to rebond it after merely cleansing the wing and tooth. Only if the wing does not deform during debonding is this conceivable. But, if only one of the bridge's abutments debonds and there are multiple abutments, caries may form. Rebonding is further complicated by the fact that many operators would rather eliminate the debonded abutment and maintain a cantilever bridge in place. The most frequent issues with resin-bonded prostheses including debonding (21%) are cavities (7%) and three-tooth discoloration (18%). From the standpoint of a physician, the fundamental benefit of RBBs is that they preserve more of the dental (9) anatomy than traditional bridge preparations do. Caries and periodontal disease are two biological causes of unsuccessful RBBs, however they are rather uncommon. In order to avoid complications, dental health knowledge should be given both during the care planning phase and after the bridge has been cemented. This includes training on dental hygiene as well as dietary suggestions and those for fluoride use (9). Debonding is the most frequent technical cause of RBB failure. According to researchers, debonding (10, 11) seems to have little to no impact on patient satisfaction, and abutment teeth often sustain only minor damage. There are two alternatives if a bridge debonds: rebonding or remaking. Recementation of the repair may be necessary if a one-time incident, like trauma, causes it to decement. Studies have revealed that once a bridge debonds, it may be more likely to fail again, making it typically imprudent to attempt to repair it again. In contrast, replacing the bridge has been proven to have a greater success rate. This is probable because the bulk of unsuccessful incidents contain a design flaw in the bridge that either existed at the time of original cementing or arose afterwards. When only one retainer malfunctions, the bridge is usually able to stay in place, encouraging the growth of carious lesions beneath the faulty retainers (13, 14). One can try to lift the retainer that remains in place using ultrasonic scaling when there is a fixed-fixed pattern when only one side is loose. Particularly in cases in which the occlusion has not been taken into consideration, parafunctional forces raise the possibility of restoration failures. During the assessment phase, any deleterious behaviors should be discovered, and the individual should be advised to stop doing things like biting their nails or pens. When bruxism is diagnosed, a night guard or occlusal splint prescription should be taken into consideration. The metallic component of the retainer was the most frequently cited factor in patients' discontent with their RBB. Metallic connectors may show across incisors due to their translucency, making them appear greyish. The usage of opaque cement and considerate retainer design, which avoids stretching the metal to below 2 mm of the incisal edge, where the enamel is significantly more translucent, can help to some degree in decreasing greying.

An RBB is considered to be less costly than a dental implant, a traditional fixed bridge, or a partial prosthesis made of cobalt-chromium. One factor for this is that RBB treatments take less time than other types of treatments; according to one research, an RBB treatment typically takes 80 minutes for completion (15). However, this does not factor in potential replacement expenses or product longevity. Extensive research has evaluated the RBB's durability. Recent investigations have revealed improved dependability and decementation incidences, which is to be anticipated given the developments in cementation materials and bonding technology. The success rates of recent studies from the late 1990s and the beginning of this decade were 93% after approximately four years, 94% after three years, and 94.3% after close to three years (16).

For acid-etch bonding to be possible, the abutment tooth or teeth must have enough enamel lingually/palatally. As a result, teeth that serve as abutment sites should preferably be healthy or have very few resin restorations. RBBs should not be provided if the teeth are extensively restored or have large carious lesions. Additionally, the clinical crown length ought to be adequate to give adequate enamel surface area. Crown lengthening may be taken into account if the crown height is inadequate. Occlusion and excursive interactions ought to be desirable or under good control. It is commonly accepted that parafunctional habits, such as bruxism, is a condition that may raise the risk of failing. The abutment teeth need to be healthy from an endodontic and periodontal standpoint, as is the case with other fixed bridgework. A clear contra-indication is the requirement for diastemata between the pontic and abutment teeth. While it is not a strict contraindication, a severely resorbed alveolar ridge in the pontic region is challenging to rebuild with any fixed bridgework. Even though there are various alloys suitable for the retainer, an additional contra-indication is an intolerance to any of the metals contained in the supporting structure (most frequently nickel).

Clinical applications and considerations

RBBs have a pivotal function in restorative dentistry, and their applications go further than lateral incisor replacements. They offer an alternative to traditional bridgework (3) or implants for restoring lost teeth, and

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because they typically don't require local anesthesia, individuals who are afraid of needles or don't want to undergo extensive surgery can have the operation. RBBs are a choice in situations where there might not be enough bone or three-dimensional space for implant implantation. Patients also prefer smaller sessions because of the cost savings compared to traditional bridgework and implant-supported restorations. The use of RBBs has limitations, just like any other form of therapy, and effectiveness is correlated with careful case selection and preparation. The patient must be dedicated, have adequate dental hygiene, and have primary dental disease in good enough condition to have any repair. Losing a tooth can cause unintended alterations and impacts in the mouth that might make it more difficult to replace a prosthesis, such as the inclination of nearby teeth or over-eruption of the opposite teeth (17). Hence, the edentulous region should be evaluated for adequate connector size and room for an esthetic pontic, taking into account not only the one arch al (6, 18) one but also both static and dynamic occlusion. The occlusal vertical dimension may need to be increased when there is insufficient space vertically. If esthetics permit, an RBB may be possible in situations where the mesio-distal size of an edentulous area is less than optimal, but implant placement may not always be viable. It can be successfully utilized into adhesive bridge pattern (19). It is often helpful in the management of instances when pre-restorative orthodontics has been completed to establish the proper gaps to replace the missing teeth since the utilization of RBBs adapts itself particularly to the restoration of missing teeth in mild or moderate hypodontia. To manage the orientation of the cuspids and avoid orthodontic relapsing, lateral incisors may be replaced with fixed-fixed pattern in cases where the canines have been de-rotated. An alternative would be to utilize an adhesive bridge with a cantilever design and offer a different type of orthodontic retention, like a vacuum formed Essix retainer, although this is dependent on the patient's adherence with retainer use and is perhaps more unpredictable. Parafunctional behaviors must be taken into account because fixed prosthodontic treatment may be more susceptible to failure in situations in which the teeth are subjected to heavy loads. Because of this, the administration of RBBs in bruxism cases requires thorough occlusal evaluation and planning. Using an occlusal splint may also be considered to safeguard restorative work (6, 18).

There will probably be more partly edentulous patients in the population as a result of an ageing society and a shift in the distribution of tooth loss. Although tolerating a gap is occasionally necessary, doing so may result in unintended issues including the neighboring teeth tilting and the unopposed teeth over-erupting, which has been documented to happen in close to 83.9% of cases (17). Adhesive bridges could thus become more and more important in the replacing of posterior teeth in a minimally invasive fashion in order to preserve tooth position. There's often a justification for a more favorable stress distribution within the structure, and the aggregated surface area of the two abutment teeth can be used more effectively. Mesial cantilevering from the second molar tooth with ample coverage occlusally, lingually, and palatally is an alternate strategy (20). However, a fixed-fixed form may be acceptable to meet the increasing occlusal loads posteriorly or if there is worry over the potential of inclination of the molar abutment. In the majority of cases, the researchers favor a cantilever arrangement in this condition. Due to higher occlusal demands, replacing posterior teeth with RBBs is less predictable than replacing anterior teeth (19, 21). There is minimal available data evaluating the variables linked to molar tooth replacement with RBB success. The rigidity of the structure, extent of coverage, and occlusion are likely to be significant considerations when using the basic guidelines listed. It is recommended to extend the retainer onto the occlusal surface of teeth posteriorly since doing so adds more enamel for adhesion and increases the rigidity of the structure. Further, since occlusal force is transmitted onto the occlusal extension and the adhesive is packed under pressure, the cement lute is shielded from shear stresses that could destabilize bridgework held in place by a retainer wing confined to the axial walls alone (21).

Conclusion

When it comes to teeth replacement, restoring dental function and appearance, and increasing patient satisfaction, RBBs can be quite effective. They stand for a long-lasting, low-cost, and minimally intrusive therapy option. The researchers found that RBBs should be more commonly taken into consideration as the preferred restoration for short time periods given complete patient evaluation and the application of appropriate therapeutic procedures.

Disclosure

Conflict of interest

There is no conflict of interest

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Data that support the findings of this study are embedded within the manuscript.

Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

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