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Review Article

Pontic design and its effects on the health of the gingiva

Meisan Ali Bukhari[1]*, Ali Mohammed Aldossari[2], Ibrahim Mohammed Alyami[2], Abdullah Hassan Al Shari[2], Abdulmunem Abdulaziz Al Huwaidi[2], Salman Youssef Alzaid[2], Ali Mohammad Alqahtani[2], Mohammed Ibrahim Musayri[2], Yahya Mohammed AlShahrani[3]

[1]North Jeddah Specialized Dental Center, King Abdullah Medical Complex, Jeddah, Saudi Arabia
[2]General Dentist, Eastern Riyadh Dental Center, Riyadh, Saudi Arabia
[3]General Dentist, Eradah Mental Health Complex, Riyadh, Saudi Arabia

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***Correspondence:**
Dr. Meisan Ali Bukhari,
E-mail: meisan-aml2000@gmail.com

ABSTRACT

A pontic is an artificial tooth that substitutes a lost natural tooth, preserves its function, and typically fills the space left by the actual crown. Sanitary/hygienic and modified sanitary/hygienic designs do not contact the alveolar mucosa. On the other hand, ridge lap, modified ridge lap, ovate, modified ovate, and conical are designs that maintain contact with the mucosa. The ideal biological properties to be taken into consideration while designing pontics are periodontal health, access for oral hygiene, no food trapping and occlusal harmony. Accumulation of dental plaque has been implicated in the onset of gingival and periodontal disease as well as caries in the vicinity of the fixed restoration. The connection of the pontic to the supporting crowns must be constructed in such a way as to make a flushable area in the direction of the gingiva, in order to ensure that this area can be cleaned by toothbrushing and flossing but not the large triangular spaces that make it easy for food particles to cling. Modified ridge lap and ovate types, out of all the pontic shapes described below, exhibit convex cleansable faces. Ovate pontics are most effective for use in anterior regions, while the modified ridge lap design can be utilized predominantly in fixed partial denture designs posteriorly. The important etiological factor for gingivitis, periodontitis and peri-implantitis is bacterial colonization which is impacted by the individual's immunologic response and genetic predisposition in addition to dental care practices and pontic design. It is believed that no matter what the material of the pontic is, it must provide a highly polished intaglio surface to help floss slide through and make contact with the full base of the pontic in order to minimize plaque accumulation.

Keywords: Pontic design, Fixed partial denture, Gingival health, Gingivitis

INTRODUCTION

On a fixed partial denture, a pontic is an artificial tooth that substitutes a lost natural tooth, preserves its function, and typically fills the space left by the actual crown.[1] For pontics, a variety of designs that adhere to the fundamentals of pontic design have been put forth.[2] Pontics with mucosal contact and no mucosal contact are two subgroups of these designs.[1,2] Sanitary/hygienic and modified sanitary/hygienic designs do not contact the alveolar mucosa. On the other hand, ridge lap, modified ridge lap, ovate, modified ovate, and conical are designs that are in contact with the mucosa. It is beneficial to take into consideration the mechanical, biological, and aesthetic requirements when designing pontics.[3] The ideal mechanical properties of a bridge pontic include rigidity, durability, and simplicity; the ideal aesthetic properties are emergence profile, natural appearance, size, shape, shade and surrounding soft tissue; and the ideal biological properties are periodontal health, access for oral hygiene, no food trapping and occlusal harmony.[3]

Research makes it evident that plaque is the main predisposing factor for the onset of gingival and

periodontal disease as well as caries.[4,5] A fixed prosthesis may make it more difficult to maintain dental hygiene, worsen plaque buildup, and raise the risk of periodontitis and dental cavities. Higher plaque buildup and gingivitis has been found to be present more frequently in areas in contact with the bridge pontic and subgingival margin of bridge retainer.[6-8] Margins coronal to gingival attachment, proper marginal fit, proper emergence form, smooth pontic faces, embrasure spacing, and less contact with and pressure on the mucosa underneath have all been suggested as features in crown and bridge construction to minimize these concerns.[9-11] To prevent plaque buildup and ulcers on the mucosa, it has been advised that pontics should be designed to minimize with contact and pressure on the underlying mucosa. Thus, overlooking fundamental prosthesis fabrication guidelines while simultaneously attempting to achieve the highest level of aesthetic result [12] might lead to the occurrence of inflammation of the gingiva around the fixed restoration. The incidence of peri-implant tissue inflammation spans from 80% to 60%, and that of biological sequelae of fixed restorations is 0.6% for a solitary crowns and 4% for bridgework.[4,5,8]

METHODS

This study is based on a comprehensive literature search conducted on October 4, 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 pontic design and its effects on the health of the gingiva. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The pontic must be esthetic (have the appearance of a natural tooth), providing sufficient hygiene in the long run, and reestablish the integrity of the dental arch which results in substantial inconsistencies in the bridge construction process.[9,12,13] The design, structure, and hygiene specifications of the pontic have been researched and found to be more important than the material on its own in preventing any inflammation of the edentulous area. In actuality, modified fixed bridge pontics are utilized.[14,15] Bridge pontic designs are proposed for various localizations and hygiene possibilities.[9,16] In addition, the connection of the pontic to the supporting crowns must be constructed in such a way as to make a flushable area in the direction of the gingiva, in order to ensure that this area can be cleaned by toothbrushing and flossing but not the large triangular spaces that make it easy for food particles to cling.[17] For the convenience of cleaning, pontic design needs to be convex on the surface of the basal tissue. Patients have trouble maintaining good hygiene because concave pontic shapes on the tissue surface are challenging to clean with dental floss or interproximal brushes. Modified ridge lap and ovate types, out of all the pontic shapes described below, exhibit convex cleansable faces. These two pontic shapes are advantageous for maintaining cleanliness because it allows to clean the base of the pontic through flossing.

Common pontic designs

Sanitary or hygienic pontic

A 2-3 mm gap exists between the tissue surface of the pontic and the ridge in the sanitary or hygienic pontic, also referred to as the "wash-through" pontic.[3] Inflammation of the mucosa and gingiva can be prevented most effectively with this design. It was created to make cleansing between the intaglio surface and the ridge simple, enabling the evacuation of food particles by the tongue and allowing complete tissue clearance. However, contrary to its name, it can provide a considerable difficulty for patients since it causes tongue irritation, is unsightly, and also causes food impaction under the pontic, leading to the accumulation a considerable quantity of plaque and food debris.[12]

Modified ridge lap pontic

A modification of the sanitary pontic design that is shaped like an archway between two connectors was created to address the issues with saddle or hygienic pontics.[18] In the molar region, where aesthetics is less important, these designs are mostly preferred.[19,20] Sanitary design pontic, as the term suggests, allows a simple setting for maintaining hygiene and removing plaque.[1,21] In one survey, 34% of the dental practitioners indicated that hygienic pontic design was their preferred choice for pontic placement posteriorly. These findings reflect those of another survey in which 34% of dentists chose a hygienic pontic design for posterior edentulous regions.[1] In one other survey, 28% out of 85 general dentists chose this design.[2] Anteriorly, designs allowing mucosal contact such as the ridge lap, modified ridge lap, ovate, modified ovate, and conical are favored because they provide a more aesthetic appearance.[12,22]

Ridge lap/saddle-shaped pontic

The ridge-lap pontic was previously utilized often in the area of the anterior dentition. The pontic has a ridge lap like shape which surrounds the ridge in the form of a saddle. This shape offers a natural emergence profile and esthetic appearance by sitting above the alveolar ridge in close mucosal contact. Nonetheless, it is crucial for a pontic to be conducive to the periodontal health of the tissues around it. Due to the difficulty in removing impacted food and maintaining periodontal health of the abutments, this design poses a concern.[3,22] The pontic's concave intaglio face makes cleansing of the are through

flossing challenging. Irritation of the mucosa and plaque buildup often result from this design. The ridge lap pontic utilization has significantly waned and it is not advised for bridgework because of this. It also leads to phonetic issues. The majority of researchers concur that the "ridge-lap" pontic is detrimental to tissue health.

Modified ridge lap pontic

A modified ridge lap design with a T-shaped intaglio surface that has a pinpoint contact was created to solve this issues of the ridge-lap design while maintaining aesthetics.[3] It makes cleansing of the pontic's ridge area simple and aesthetically seems as though it is growing out of the tooth. This modification has the benefit of not requiring any preoperative interventions. The area of the lateral dentition is suited for the modified ridge-lap pontic.[1,18] It is utilized most frequently in clinical practice due to the sanitary angle that is formed when creating the oral surface.[23,24] Ovate pontics are most effective for use in anterior regions, while the modified ridge lap design can be utilized predominantly in fixed partial denture designs posteriorly.

Incorporating better hygiene characteristics and addressing the issues with the ridge lap/saddle pontic are the goals of the modified ridge lap pontic. Stein [10] promoted its adoption after researching the impact of various pontic designs on the neighboring mucosal tissues and concluding that the modified ridge lap design was acceptable in terms of both appearance and health of the mucosa. It was advised that the mucosal surface should not be compressed and that it only makes minimal point contact labially/buccally. Modified ridge lap is one of the most frequently desired pontic designs. The modified ridge lap has the following benefits: Convexity of surfaces which makes cleansing through flossing straightforward; they provide an aesthetic appearance; and they possess high mechanical durability. The emergence profile of this design, though, can be suboptimal in some situations, resulting in a reduced esthetic appeal. When better results are needed aesthetically, such as in the front region in a patient with a high smile line, and when other options, like implant placement, are not a feasible, a different strategy could be needed.

Posteriorly, the modified ridge-lap design and, anteriorly, the ridge-lap facing design provide minimal tissue contact, acceptable aesthetics, appropriate buccal support, and access for good dental hygiene.[25]

Ovate pontic

Ovate pontics, in contrast to modified ridge lap pontics, have rounded tissue surfaces and are embedded at least 2 millimeters into the tissues. For preparation of the alveolar ridge for the fixed partial denture, they need to undergo a specific pre-operative procedure.[12] By surgically altering the soft tissue or bone beneath the pontic, or by gradually exerting higher pressure with an interim restoration, the tissue contouring under the pontic can be modified. The ovate pontic [26] is a method recommended for bridgework anteriorly that demands attention towards esthetics. An ovate pontic can be described as one that increases mucosal contact and lightly presses the underlying mucosa in an effort to enhance esthetics.[26,27] This pontic design has been created to tackle the problem of emergence profile aesthetics. They have a very rounded easily cleaned intaglio surface and deliver outstanding aesthetic outcomes.[18,28] They also have an advantage over the ridge lap design in that the metal backing provides better support for the porcelain covering the gingival area. As a result, they are less prone to porcelain cracks than ridge lap design.[18] They are simple via flossing and do not interfere with phonetics. To avoid any issues with mucosal contact and minimal tissue pressure, the ovate pontic should be used in conjunction with efficient dental hygiene techniques.

Modified ovate pontic

This pontic minimizes the appearance of black triangles interproximally and is called modified ovate. It is distinguished by a less pronounced vestibular curvature.[29,30]

Conical pontic

The use of conic pontics has waned due to difficulty in maintaining hygiene. For the molar region, in cases of ridge resorption, the conical-shaped pontic is advised.[31,32] These designs are chosen based on the esthetics preferred, pattern of resorption, and the amount of available space for the pontic. The laboratory must get written instructions from the restorative dentalcare provider regarding the design.[1,12]

Bullet-shaped pontic

The lateral arch region is appropriate for the bullet-shaped pontic. Some researchers have recommended the "bullet-shaped" pontic for the region of the posterior ridge when there is alveolar ridge is resorbed.

Pontic material considerations

Many researchers have noted that plaque buildup on the pontics' surface is likely the cause of the edentulous mucosa next to it becoming inflamed.[33] According to certain research, the mucosal response would be negligible if the pontic's tissue surface was made of a glazed or polished substance. Owing to its lesser plaque buildup, porcelain was chosen as the material for the intaglio-surface of pontics. Recent research has established that the pontic material utilized has no bearing on the tissue response. The tissue does not significantly differ depending on whether gold, acrylic resin, or glazed or unglazed porcelain is utilized.[33] No matter the material

chosen, a highly polished finish is advised to prevent plaque buildup.

Gingival and periodontal considerations

The important etiological factor for gingivitis, periodontitis and peri-implantitis is bacterial colonization, which is impacted by the individual's immunologic response.[34-36] Although researchers were unable to find a cause-and-effect theory connecting microbial buildup and periimplantitis, genetic susceptibility is also relevant.[37,38] By inhibiting the prosthesis' ability to self-clean and producing direct physical tissue damage (during the preparation of abutments and impression taking) as well as aggravated plaque adhesion (due to inadequate hygiene), these factors can all raise the risk of morbidity.[16,39] Mucositis and gingivitis are the initial stages of inflammation, which progress to periodontitis and periimplantitis with poor care.[16,40] Knowledge, technical proficiency, care planning, and open communication between the dental practitioner and the dental laboratory technician are crucial for risk reduction. The need for prompt discovery of current issues in order to mitigate and avoid them must be brought to the attention of the professionals participating in the process.[41] It is important to pay attention to the design of the bridge pontic and its connection to the abutment in order to guarantee the prosthetics' functionality (including the phonetic aspect and chewing), aesthetics, hygiene, and mechanical stability all at once. Fixed partial dentures supported by dentition or implants may irritate the soft tissues surrounding the prosthesis.[42]

Plaque control is crucial for preserving the health of the mucosal tissues and the periodontium, according to studies on the periodontal effects of restorative prosthesis. Silness et al studied the impact of flossing and interdental brushing on the mucosal and gingival health of those bearing bridge pontics.[43] This study shown that by using regular, efficient dental hygiene techniques, mucosal and gingival health may be preserved even with the interaction with and compression from the pontic. The accessibility for effective plaque control and the effectiveness with which this may be carried out are the crucial components for the biologic viability of any pontic architecture.

Clinical considerations

The pontic must provide a highly polished intaglio surface with convexity to help floss slide through and make contact with the full intaglio surface of the pontic in order to minimize plaque accumulation. Based on the width and viscoelasticity of the mucosa, the pontic ought to be created so that the convexity continues into the mucosal surface by 1-2 mm.[3] This mucosal depth enables a more natural-looking tooth substitute by giving the impression that the pontic is emerging from the gingival tissues. The papillae may be preserved and sustained when utilized as an immediate replacement, and this may lessen the appearance of "black triangles," which are caused when interdental papillae recede. For this purpose, the ovate pontic has several benefits, including a convex surface to facilitate flossing, superior esthetics, particularly in the emergence profile, support and papillary maintenance, a decrease in the appearance of black triangles, and mechanical durability.[26,27]

It is essential to open embrasure gaps near abutments in addition to appropriately planning the intaglio surface of pontics in order to provide space for interproximal tissue and accessibility for dental hygiene. The occlusal region should not be constricted arbitrarily because this could lead to a condition where food gets trapped and/or plaque gets retained, just like with malpositioned teeth. To increase strength, lessen food and plaque accumulation, and make it easier to perform dental hygiene operations beneath the pontic areas, the embrasure gap between two neighboring pontics is typically closed.[44]

CONCLUSION

It is now known that the design of the pontic, rather than the material used to fabricate it, may be the most crucial element in preventing inflammation. The continued engagement of the patient and the caregiver is necessary in the long run for the stability of the restoration and the periodontal structures. A careful maintenance schedule can assure the restoration's longevity once it has been designed with attention to all the variables guiding the accomplishment of suitable soft tissue health and has been positioned in this healthy environment. The conservation of this delicate state of cohabitation between the soft tissue and the prosthesis relies on timely maintenance checkups and sufficient plaque control by a willing patient.

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