Use of a Modified Ovate Pontic in Areas of Ridge Defects: A Report of Two Cases

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ABSTRACT

A modified design for ovate pontics is proposed to achieve the esthetic, functional, and hygienic requirements for fixed partial dentures. This design should aid the clinician in preparing the edentulous area, thus resulting in less discomfort for the patient because little to no ridge augmentation is required. The same emergence profile can be developed as with the classic ovate pontic design.

CLINICAL SIGNIFICANCE

A modified ovate pontic has the following advantages: excellent esthetics because it produces a correct emergence profile; fulfilled functional requirements; greater ease of cleaning as compared with the ovate pontic; an effective air seal, which eliminates air or saliva leakage; the appearance of a free gingival margin and interdental papilla; elimination or minimization of the "black triangle" between the teeth; and little or no ridge augmentation required prior to the final restoration.

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Pontic design is important to determine prior to fixed partial denture reconstruction; the type of pontic influences the surgical procedure if the edentulous area has a ridge defect. Four basic pontic designs have been used over the years: sanitary (hygienic), ridge lap (full ridge lap, total ridge lap) (Figure 1A), modified ridge lap (Figure 1B), and ovate (Figure 1C). The modified ovate pontic design meets all the requirements that one desires in a pontic, whereas the other types of pontics may not. Various aspects of all five types of pontics are compared in Table 1.

SANITARY (HYGIENIC) PONTIC

The sanitary or hygienic pontic does not come in contact with the edentulous ridge and provides a wide space by which to maintain oral hygiene.[1] However, although the pontic facilitates effective cleansing of the prosthesis and tissues, many patients object to the gap and the food trap it provides, as well as the way the pontic feels against the tongue. It is seldom used

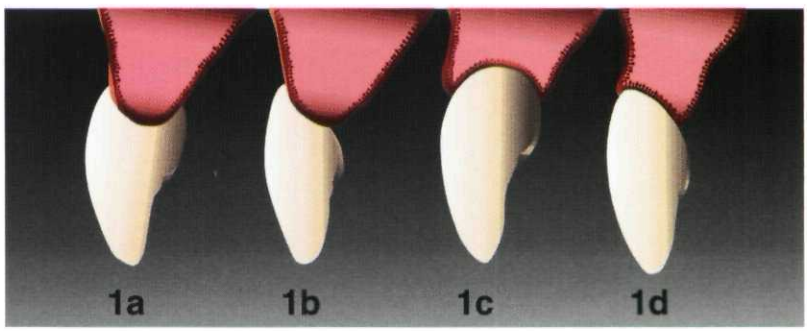

Figure 1. Pontic designs: A, *ridge lap (full ridge lap, total ridge lap);* B, *modified ridge lap;* C, *ovate pontic;* D, *modified ovate pontic. (Graph designed by Mr. ChunHsiung Chen)*

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TABLE 1. CHARACTERISTICS OF FIVE TYPES OF PONTIC.

Characteristic	Sanitary	Total Ridge Lap	Modified Ridge Lap	Ovate	Modified Ovate
Indication	Posterior teeth	Anterior and posterior teeth	Anterior and posterior teeth	Anterior and posterior teeth; high smile line	Anterior and posterior teeth; high smile line
Contraindication	Anterior teeth	—	—	A thin, knife-edged ridge	—
Esthetic concern	Not for use in cosmetic zone	Reasonably good esthetics	Reasonably good esthetics	Excellent esthetics and emergence profile	Excellent esthetics and emergence profile
Tissue surface of pontic	Convex; free contact	Concave; rests on top of tissue tightly	Concave	Convex	Convex
Cleansing/ hygiene	Effective	Difficult	Easier than for total ridge lap	Easier than for modified ridge lap; sometimes floss cannot pass center of pontic	Easiest
Speech	—	—	Not enough air seal for speech	More effective air seal for speech than with modified ridge lap	More effective air seal for speech than with modified ridge lap
Disadvantages	Food gets trapped; feels odd against tongue (seldom used today)	Food gets trapped, cannot clean; cause of periodontal disease	Food gets trapped at lingual triangle open area Saliva to be forced through space during speech	Ridge augmentation surgery needed if ridge collapsed	May leave shadow in apical area of tooth-gingival margin if Class I ridge defect and high smile line
Advantages	—	—	—	Creates illusion of free gingival margin and papilla Minimizes "black triangles"	Creates illusion of free gingival margin and papilla Minimizes "black triangles" Requires less ridge augmentation surgery than ovate pontic
Developer, study	—	—	Stein, 1966[5]	Abrams, 1980[8]	Liu, 2003

today and rarely, if ever, in the esthetic zone.

RIDGE LAP PONTIC

The ridge lap design provides reasonably good esthetics; however, if the ridge is resorbed on the facial surface, it can look artificial.[2] The large, concave tissue surface of the pontic makes the removal of adherent plaque often quite difficult.[3,4] Inflammation and ulceration of the soft tissue are often associated with this type of pontic.

MODIFIED RIDGE LAP PONTIC

The modified ridge lap design is the most popular type of pontic. It usually results in less inflammation in the ridge contacting area as compared with the ridge lap pontic owing to its smaller concave surface and ease of cleansing.[5,6] However, there is still a concave surface in the center of the tissue surface that is often difficult to negotiate with dental floss and/or mechanical cleansing devices.[7] If the edentulous ridge is not severely resorbed, acceptable esthetics can usually be expected.

OVATE PONTIC

The ovate pontic was developed by Abrams in 1980.[8] Instead of a concave shape at the tissue surface, the ovate pontic was created with a convex shape to overcome the disadvantage of the ridge lap or modified ridge lap. As a result, this pontic is easier to clean. However, the height of contour of the convex surface was designed close to the center of the base, and sometimes floss cannot pass through the center of pontic, especially in thin-scalloped periodontium, in which there is a longer distance from the top of papilla to the labial gingival margin.[9–11]

The convex nature of the ovate pontic was created to develop the correct emergence profile. However, in contrast to the requirements for pontics, which suggest the importance of pressure-free contact over a small area, the ovate pontic comes in contact with a larger area of the underlying soft tissue and applies *very light* pressure.[12]

The advantages of the ovate pontic lie in its ability to achieve maximum esthetics and that it is usually easier to clean than the ridge lap types. Its major disadvantage is that it requires a sufficient faciolingual width and apicocoronal thickness to house the ovate pontic within the edentulous ridge. A thin knife-edge ridge is often a contraindication for an ovate type of pontic. If the faciolingual and apicoincisal dimensions are inadequate, a surgical augmentation procedure is often indicated. Various techniques are available for this purpose, depending upon the type and extent of the ridge defect.

In 1983 Seibert classified ridge defects into three general categories[13]:

- Class I. Buccolingual loss of tissue with normal ridge height in an apicocoronal dimension
- Class II. Apicocoronal loss of tissue with normal ridge width in a buccolingual dimension
- Class III. Combination buccolingual and apicocoronal loss of tissue resulting in loss of normal height and width

The available ridge-management techniques to esthetically enhance restorations are as follows:

- Socket preservation technique. Greenstein described this technique to prevent ridge collapse in which bone graft material is applied directly after the extraction of the tooth.[14]
- Full-thickness soft tissue grafts. Meltzer published the first clinical report on using a soft tissue graft solely to correct an esthetic, anterior, vertical ridge defect.[15] Seibert described a free-gingiva onlay graft technique to reconstruct the deformed, partially edentulous ridges.[13,16]
- Pouch procedure. Garber and Rosenberg developed a technique for treating ridges that have a horizontal loss of dimension. It involves the subepithelial placement of a connective tissue graft from the tuberosity.[17] The technique was a refinement of those suggested by Langer and Calagna and by Abrams.[8,18]
- Ridge augmentation-improved technique. Allen designed an improved surgical technique for localized ridge augmentation that was similar to that previously

described by Kaldahl, except that the graft material was a hydroxyapatite implant.[19,20]

- Subepithelial connective tissue graft. Langer and Calagna outlined a combination of a partial-thickness flap and a connective tissue graft to achieve ridge augmentation.[18,21]
- Immediate pontic technique. Spear suggested a way to maintain the interdental papilla following anterior tooth removal. The provisional was modified to prevent the socket from collapsing and to imitate the natural emergence profile.[22]

MODIFIED OVATE PONTIC

The modified ovate pontic design (Figure 1D) was developed to circumvent the problems encountered with the ovate pontic. The modification of the ovate pontic involves moving the height of contour at the tissue surface from the center of the base to a more labial position. The modified ovate pontic does not require as much faciolingual thickness to create an emergence profile. It is much easier to clean compared with the ovate pontic owing to the less convex design. Its major advantage over the ovate type is that often there is little or no need for surgical augmentation of the ridge.

The height of contour at the tissue surface of the pontic is 1 to 1.5 mm apical and palatal to the labial gingival margin. Dental floss can be used to push the labial gingival margin away and cleanse the tissue surface without any difficulty, in contrast with other pontic types (Figure 2). The labial gingival margin rebounds after the dental floss is removed. The tissue surface of the modified pontic is less convex than that of the ovate pontic.

The following cases describe how to create the modified ovate pontic.

Case 1

A 22-year-old female presented with resin-bonded bridges (Maryland Bridges) that had replaced her congenitally missing maxillary lateral incisors 9 years previously. Her chief complaint was an esthetic concern regarding her smile. The bonding had been done several times since the initial placement, and some material was now showing through the labial surface (Figure 3). The crown shade did not match the other natural teeth (see Figure 3). The long axes of the two lateral incisors tilted distally, and the maxillary right canine was shorter than left canine (see Figure 3B).

Clinical Treatment. The two resin-bonded bridges were removed, and a six-unit fixed provisional was fabricated. The long axes of the maxillary lateral incisors were corrected and tilted mesially (Figure 4). A crown-lengthening procedure was performed to lengthen the maxillary right canine (Figure 5); tooth preparation was done at the same time. The finish line was extended to the gingival margin, and the provisional crown margin was extended to the new finish line (Figure 6). Gingivoplasty was performed with a football-shaped diamond. A 30 to 45° gingivoplasty

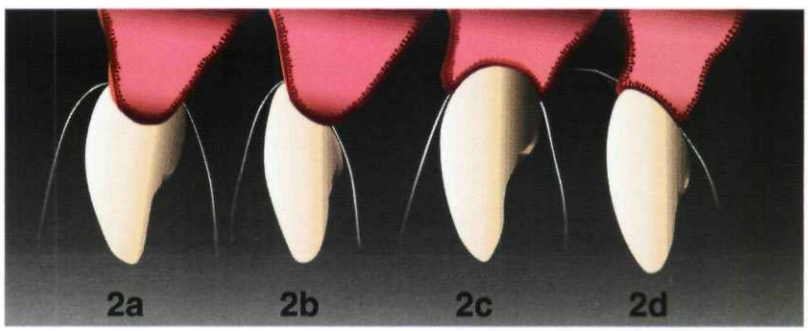

Figure 2. Cleansing of pontic designs. A, *Ridge lap: dental floss cannot contact the pontic tissue surface in the concavity.* B, *Modified ridge lap: dental floss can contact more of the tissue surface of the modified ridge lap, but a concave area remains in the center of the tissue-contacting surface that cannot be cleansed.* C, *Ovate pontic: dental floss can be brought into intimate contact with most of the tissue-contacting surface.* D, *Modified ovate pontic: dental floss can be brought into intimate contact with the tissue-contacting surface. (Graph designed by Mr. ChunHsiung Chen)*

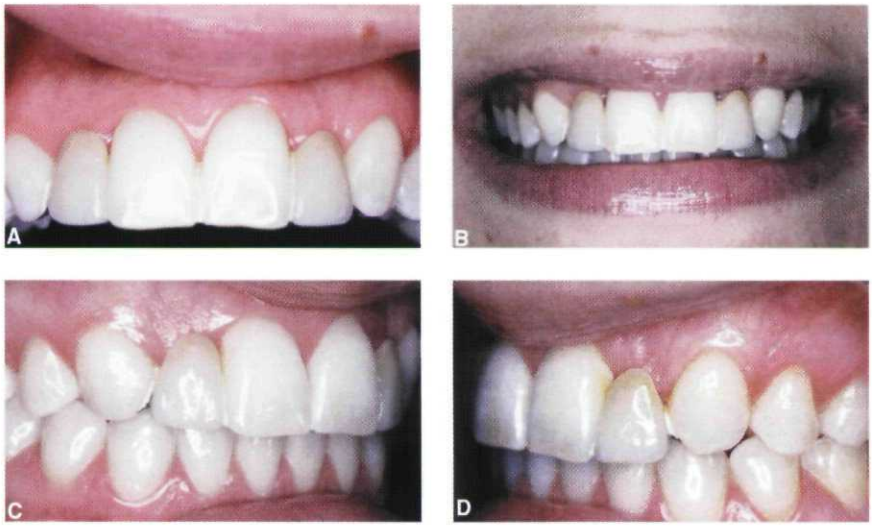

Figure 3. Case 1. A 22-year-old female had resin-bonded bridges to replace her congenitally missing maxillary lateral incisors 9 years previously. Her chief complaint was an esthetic concern regarding her smile. The bonding had been done several times, and some material was now showing through the labial surface. The crown shade did not match that of the natural teeth. The long axes of the two lateral incisors tilted distally, and the maxillary right canine was shorter than the left canine (B).

was made in the labial edentulous area and extended apically and palatally 1 to 1.5 mm from the labial gingival margin (Figure 7). The lingual edentulous area was prepared to create a shallow concavity (Figures 8 and 9). The provisional was built up to create a modified ovate pontic with a shallow convexity (see Figure 9B), then the provisional was inserted back right after gingivoplasty procedure (Figure 10). Figure 6 shows the papilla between two central incisors collapse and become inflamed; some acrylic was added to the mesial aspects of provisional margin to support the papilla properly (see Figure 10). Figures 11 and 12 demonstrate the restorations at initial insertion and at a 27-month follow-up, respectively.

Case 2

A 45-year-old female presented to our clinic. Her maxillary left central incisor had been extracted by her family dentist 3 months prior to presentation. There was 2 mm of attachment loss at the mesial papilla area of the maxillary right central incisor, and 2 to 3 mm of attachment loss at the mesial papilla area of the maxillary left lateral incisor (Figure 13). The tissue surface of the provisional pontic was built up to create the modified ovate pontic design by exerting light pressure on the labial, mesial, and distal soft tissue areas (Figure 14). Care was taken to ensure that dental floss could pass between the pontic

Figure 4. Case 1. The two resin-bonded bridges were removed and a six-unit fixed provisional was fabricated. The long axes of maxillary lateral incisors were corrected and tilted mesially.

Figure 5. Case 1. A crown-lengthening procedure was performed to lengthen the maxillary right canine.

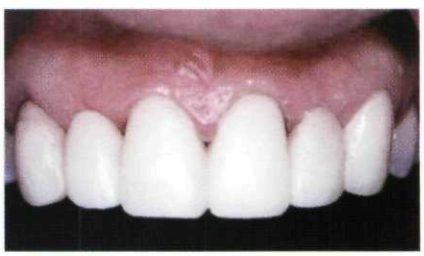

Figure 6. Case 1. Tooth preparation was done at the time of crown lengthening. The finish line was extended to the gingival margin, and the provisional crown was extended to the new finish line.

Figure 7. Case 1. Gingivoplasty was performed with a football-shaped diamond. A 30 to 45° gingivoplasty was made in the labial edentulous area and extended apically and palatally 1 to 1.5 mm from the labial gingival margin.

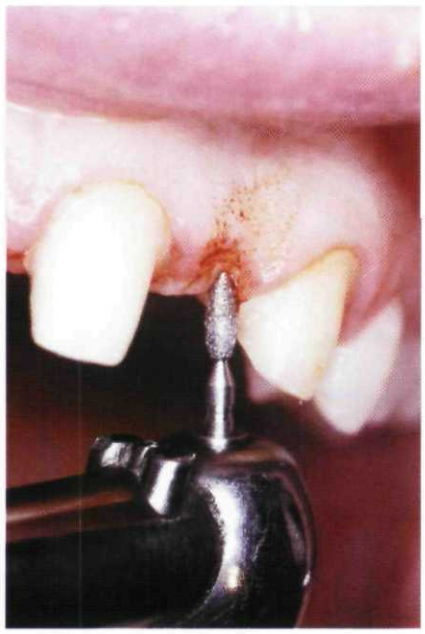

Figure 8. Case 1. The lingual edentulous area was prepared to create a shallow concavity.

and the underlying soft tissue, especially in the center (Figure 15). A yellow gold undercasting was fabricated, and acrylic was applied to the pontic area to relate the edentulous soft tissue (Figure 16). The final fixed partial denture was completed 8 months after placement of the provisional (Figure 17). Figures 18 and 19 demonstrate the restoration at 1 and 2 year follow-ups, respectively.

DISCUSSION

Pontics of fixed partial dentures have to fulfill esthetic, functional, and hygienic requirements. For years controversy has existed regarding the pontic surface abuting the tissue. With the use of the ridge lap pontic, alveolar ridge deficiencies were accommodated, but oral hygiene was difficult because of the concave pontic design. The sanitary pontic and the modified ridge lap pontic were developed to avoid or minimize any contact between the pontic and edentulous ridge mucosa, but they did not satisfy the esthetic requirements. The ovate pontic was developed to fulfill esthetic and functional requirements. Its convex pontic design was intended to fabricate a concave soft tissue outline in the edentulous ridge mucosa. However, at times floss cannot pass through the center of pontic, especially in anterior teeth area, where the distance from the top of papilla to the labial gingival margin is longer than in posterior teeth area. (The cementoenamel junction is more curved in anterior teeth, and there is more convexity as compared with posterior teeth area.) The modified ovate pontic was developed to circumvent this problem. This pontic is less convex and often requires little or no ridge augmentation (see Table 1).

Figure 9. Case 1. A *and* B, *The provisional was relined to create a modified ovate pontic with a shallow convexity.*

Figure 10. Case 1. Four weeks after the insertion of the provisional.

Figure 11. Case 1. Initial insertion. The final fixed partial denture was fabricated by a fourth-year dental student.

Figure 12. Case 1. Restoration at a follow-up after 2 years and 3 months.

Figure 13. Case 2. This 45-year-old female's maxillary left central incisor had been extracted by her family dentist 3 months prior to presentation. There was 2 mm of attachment loss at the mesial papilla area of the maxillary right central incisor and 2 to 3 mm of attachment loss at the mesial papilla area of maxillary left lateral incisor.

Some investigators have reported that soft tissue–contacting pontics have been associated with clinical signs of inflammation such as swelling, edema, and histologic changes.[23–26] However, oral hygiene was not the main concern of these investigators; their primary concerns were the composition and surface texture of the pontic material, the design of the pontic, and the degree of pressure placed on the edentulous ridge mucosa by the pontic.

Zitzmann and colleagues' study on premolars and molars noted that an edentulous space with an ovate pontic supported by adequate oral hygiene was not associated with overt clinical signs of inflammation.[27] Histologically, the ovate pontic design was associated with a thinner keratin layer and with changes in the composition of the connective tissue component subjacent to the epithelium.

Silness and colleagues and Tolboe and colleagues reported that clinically healthy conditions can be established at pontic sites if appropriate plaque control with dental floss and/or super floss is performed.[28,29] Tripodakis and Constantinides demonstrated that "hyperpressure" exerted from an ovate pontic resulted in a thinning of the epithelium, but no distinct histometric or morphometric measures were presented.[7]

The modified ovate pontic has less soft tissue–contacting surface and less curvature than the ovate pontic. This modified pontic fulfills not only the esthetic and functional demands but also the hygienic requirements. It is much easier to clean than the ovate pontic.

CONCLUSIONS

The modified ovate pontic is proposed to achieve the cosmetic,

Figure 14. Case 2. A *and* B, *The tissue surface of the provisional pontic was built up to create the modified ovate pontic design by exerting light pressure on the labial, mesial, and distal soft tissue areas.*

Figure 15. Case 2. Care was taken to ensure that dental floss could pass between the pontic and underlying soft tissue, especially in the center.

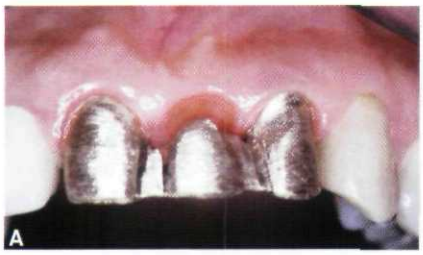

Figure 16. Case 2. A *and* B, *A yellow gold undercasting was fabricated, and acrylic was applied to the pontic area to relate the edentulous soft tissue.*

Figure 17. Case 2. Final fixed partial denture was finished 8 months after placement of the provisional.

functional, and hygienic requirements for fixed partial dentures. It usually minimizes discomfort for patients because little or no ridge augmentation is required. Basically, the same emergence profile can be developed as compared with the ovate pontic.

In the author's experience, the following advantages maybe observed when using the modified ovate pontic:

- Excellent esthetics because it produces a correct emergence profile
- Fulfilled functional requirements
- Greater ease of cleaning compared with the ovate pontic
- An effective air seal, which eliminates air or saliva leakage
- The appearance of a free gingival margin and interdental papilla
- Elimination or minimization of the "black triangle" between the teeth
- Little or no ridge augmentation required prior to the final restoration

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This article is dedicated to the late Jay S. Seibert, DDS, my mentor in periodontics.

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Figure 18. Case 2. Restoration at 1 year.

Figure 19. Case 2. Restoration at 2 years.

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