

RIDGE-LAPPING RESTORATIVE CROWNS OVER ENDOSTEAL AND SUBPERIOSTEAL IMPLANT ABUTMENTS

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KEY WORDS

Dental implant
Ridge lap
Pergingival site
Emergent profile
Prosthodontics
Aesthetics

Crowns on countless dental implant abutments have been successfully ridge lapped for over 25 years. When properly fabricated, ease of cleansing and maintenance of health at the pergingival site is routine. The advantages of this technique are significant. It promotes pleasing aesthetic results almost regardless of the vestibulo-lingual and mesio-distal location of the abutment relative to the required position of the crown. The technique-sensitive procedures associated with the creation and maintenance of acceptable emergent profiles are rendered unnecessary. Ridge lapping is compatible with abutment heads of any diameter and configuration and with cementable or screw-retained fixed prostheses. This article discusses current opinion and controversy regarding ridge lapping of crowns over implant abutments and offers step-by-step procedures in the diagnosis, design, fabrication, and professional and home care maintenance of highly aesthetic ridge-lapped crowns over abutments of the common dental implant modalities.

INTRODUCTION

This article discusses current opinion regarding ridge lapping of crowns over implant abutments and offers step-by-step procedures in the diagnosis, design, fabrication, professional maintenance, and home care of highly aesthetic ridge-lapped crowns over abutments of the common dental implant modalities.

For more than 25 years, restorative crowns with pergingival sites in attached gingiva have been successfully ridge lapped over dental implants that have healed in any one of the three modes of tissue integration.¹⁻⁴ In fact,

until the emergent profile technique was introduced in the mid-1990s, ridge lapping was the predominant technique to provide fixed restorations over all types of implant abutments.^{3,4} Almost every textbook of implant dentistry has several figures showing palatally placed implants that have been aesthetically ridge lapped,^{3,4} although the term ridge lapping tends to be avoided due to a negative connotation it was given when the emergent profile technique was first introduced.

Over 50% of the pergingival sites around root forms that have been submerged during healing are in unat-

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tached gingiva,⁵ rendering them less than ideal for ridge lapping. For that reason, the current trend is to semisubmerge root forms so that their healing collars are flush with or 1 mm above the gingiva at the time of insertion. Attached gingiva is positioned and sutured at the pergingival site at the location desired by the practitioner. The protocol for plate/blade forms and subperiosteal implants has always been to position attached gingiva at the pergingival site at the time of insertion. When ridge lapping is properly configured, ease of cleansing is routine and maintenance of health at the pergingival site is comparable with that of splinted and unsplinted abutments supporting overdentures.

Despite its long-term success, ridge lapping has been a controversial procedure. Many practitioners assume that successful ridge lapping over dental implants is not possible because it cannot be predictably performed when crowning malposed natural teeth. It should be noted that the microanatomy around the sulci of natural teeth and implants differs.⁶ Studies on the role of cementum in the etiology of periodontal disease suggest that its affinity to endotoxins may contribute to the complications encountered when ridge lapping teeth.^{7,8} The absence of cementum at the implant site may contribute to an implant abutment's ability to function asymptotically in long-term health under a ridge-lapped crown.

The advantages of ridge lapping are significant. Ridge lapping promotes pleasing aesthetics almost regardless of the labio/bucco-lingual and mesiodistal position of the abutment under the restorative crown. Ridge lapping is compatible with conventional and custom abutments of all dental implants and with the fabrication of cementable or screw-retained prostheses. The technique-sensitive and complex procedures currently associated with the creation and maintenance of an acceptable emergent profile to enhance

aesthetics are avoided when ridge lapping.

ANALYSIS OF THE AESTHETIC PROBLEM

Healed ridge crest positions following tooth removal

In a mainstream implant dentistry case, the patient presents with a healed partially or totally edentulous alveolar ridge with available bone sufficient for the utilization of an accepted implant modality.⁹ During implant insertion, there is no need for enhancement of either the overlying soft tissues or the underlying bone if the case is mainstream.

The anatomy and final position of healed alveolar ridges is the underlying cause of many restorative problems and of the difficulty in achieving acceptable aesthetics. One solution to this problem is ridge lapping. Following tooth removal, substantial resorption occurs at the crest and at the expense of the facial aspect of the ridge. Only slight changes occur lingually. As a result of this resorption, in almost every case, the crest of the healed alveolar ridge is medial or lingual to the original position of the central fossae or incisal edges of the teeth when they were in place.

Ideally, the abutment bisects the ridge crest, with at least 1 mm of bone present on its facial and lingual sides. Therefore, an endosteal abutment emerges somewhat lingual to what will be a preferred tooth position following restoration (Figure 1). There is also a range of thickness of overlying tissues and a variety of possible occlusal relationships, including interocclusal clearance and vertical dimension. Anteriorly, particularly in the maxilla, the aesthetic challenges are great, even in mainstream cases.

Effects of prior periodontal disease, long-term edentulism, and function under removable restorations

Cases with significant prior periodontal disease cannot be considered main-

stream. One observes irregularities in the buccal/labial bony contours and often variations in crestal height mesiodistally, even in the same patient. This further compromises one's ability to achieve an aesthetic result.

The effect of time on edentulous ridges varies. The function of the alveolar ridge is to absorb and transmit the forces of occlusion that pass through the tooth root to investing bone. Following tooth removal, edentulous ridges atrophy due to hypofunction. In a typical 5-year period, an unimplanted edentulous ridge loses twice as much bone as one into which endosteal implants have been inserted¹⁰ because such treatment returns the ridge to its intended function of absorbing and transmitting forces of occlusion to the surrounding bone. Over time, loss of bone height and width in unimplanted edentulous ridges compromises the potential to perform implant treatment and adversely affects aesthetics.

Edentulous ridges under complete or partial removal dentures lose bone at a more accelerated rate. The negative effects of long-term edentulism are exacerbated. In the case of partial removable dentures, the problems are more complex, as the crestal level under the flanges is more resorbed than the crest of the adjacent natural dentition to which the partial denture is affixed for retention (Figure 2). This further affects aesthetics negatively.

REQUIREMENTS FOR THE EMERGENT PROFILE WITH ROOT FORM ABUTMENTS

At the chosen site for placement, root forms require adequate bone volume bucco/labio-lingually to ensure at least 1 mm of bone on each side following insertion. For aesthetic considerations in the anterior maxilla and mandible when the emergent profile option is chosen, there must be sufficient thickness of overlying soft tissue.

Clinically, there is often little leeway in the labio/bucco-lingual positioning of a root form abutment due to the di-

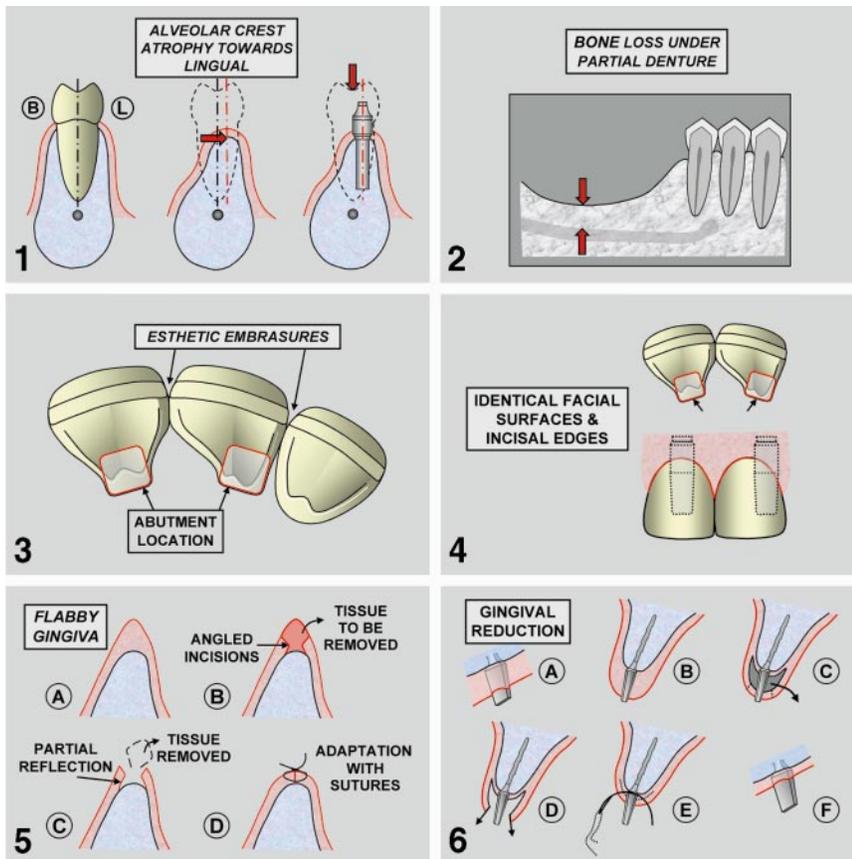


FIGURE 1. Endosteal implant abutments emerge toward the lingual of their restorative crowns.

FIGURE 2. The rate of resorption of edentulous ridge crests under removable partial dentures is accelerated.

FIGURE 3. The distance between the abutment and the facial aspect of the restoration promotes aesthetic embrasures.

FIGURE 4. Fine aesthetics can be achieved whether the abutment emerges centrally or off center under the restoration. Variations in crown contouring are related to abutment head location hidden behind ridge lap.

FIGURE 5. Excessively high or flabby tissue in the anterior mandible is readily corrected.

FIGURE 6. Reduction of excessively thick tissue in the posterior maxilla presents a greater challenge but is predictable.

mensions of both the implant and the available bone. Typically, there is even less leeway in its mesio-distal positioning. The emergent profile technique requires that a root form abutment be placed centrally under its corresponding crown restoration for proper aesthetics and occlusion.¹¹ Therefore, even if there is a more favorable volume of available bone within a few millimeters of this required position mesio-distally, it may not be possible to utilize it due to aesthetic considerations. Proper mesio-distal tooth positioning enhances

aesthetics and occlusion. Improper mesio-distal positioning may seriously compromise the contours of an emergent profile.

To create a useful emergent profile, one may require greater gingival thickness than is present in a given case. This can be resolved in either of two ways. Bone height can be reduced to increase gingival thickness, assuming that the remaining depth will be adequate to insert an implant that can support the anticipated load. Or, given adequate interocclusal clearance, one may

graft additional gingival thickness where it is needed,¹² with all of the complexities and complications that this implies. The aesthetics of anterior emergent profile root form implant prosthodontics is one of the most difficult and time-consuming issues related to implant dentistry treatment.

POSITIONING OF IMPLANT ABUTMENTS FOR RIDGE LAPPING

Root form abutment positioning

The diameter of the implant is not a limiting factor. When ridge lapping, implant diameter is not a consideration for aesthetics. Since the abutment is hidden behind the ridge lap, it has no relationship to the aesthetic result. This is a significant advantage because it affords the practitioner greater latitude in implant diameter selection to take greatest advantage of existing available bone and decreases the need for augmentation of soft and/or hard tissues.

Within a wide range, the mesio-distal positioning of a root form implant is not a limiting factor. Ridge lapping permits the abutment head to protrude into this overlying crown at almost any mesio-distal point under the crown. The ridge-lapped crown can be fabricated for ideal tooth positioning and aesthetics, no matter where the abutment protrudes into the crown's tissue surface.¹³

The bucco/labio-lingual position of the ridge crest is not a limiting factor. The abutment head of the implant will almost always protrude from the healed ridge crest toward the lingual border of the planned position of the overlying crown (Figure 1). This is an advantage when ridge lapping is employed. As a result of this lingual positioning, when the facial aspect of each crown is positioned properly, porcelain or resin thickness between the abutment head and the facial surface is sufficient to ensure that the resulting embrasures can be fashioned with ideal contours for aesthetics and ease of cleansing, even if the abutment pro-

trudes toward an embrasure area (Figure 3).

The thickness of overlying soft tissue may impact on interocclusal clearance or limit abutment retention height. This is not a limiting factor for achieving aesthetics. Again, when ridge lapping, it is not necessary to follow the regimen required to achieve an aesthetic result with an emergent profile. Tissue of any thickness may remain unaltered. It is almost never necessary to reduce the height of the ridge crest to obtain tissue of sufficient thickness solely for proper aesthetics. Advantageous available bone slightly mesial or distal to the central axis of the overlying crown can be utilized without compromising aesthetics, again because the ridge lap masks the abutment (Figures 3, 4). In some cases, most often in maxilla or anterior mandible, overlying tissue can be so thick and/or flabby that it interferes with adequate interocclusal clearance. Plastic surgery is then required to ensure adequate height of the abutment attachment mechanism and/or adequate interocclusal clearance (Figures 5, 6).

The abutment head configuration is not a limiting factor. There are numerous options available for root form implants. Whatever angle of insertion is required for implant placement, abutment heads are available or can be fabricated to be prosthodontically parallel. They may also be either screw-retained or cemented.

Plate/blade form abutment positioning

The mesio-distal position of the plate/blade form is not a limiting factor. There are more than 90 different configurations of plate/blade form implants. The primary consideration in selecting the proper configuration, assuming adequate ridge width, is to utilize the volume of available bone as fully as possible. Utilizing a blade guide transparency in conjunction with a long-cone periapical radiograph (Figure 7) helps one choose the implant that will best utilize the available bone to provide the greatest margin of safe-

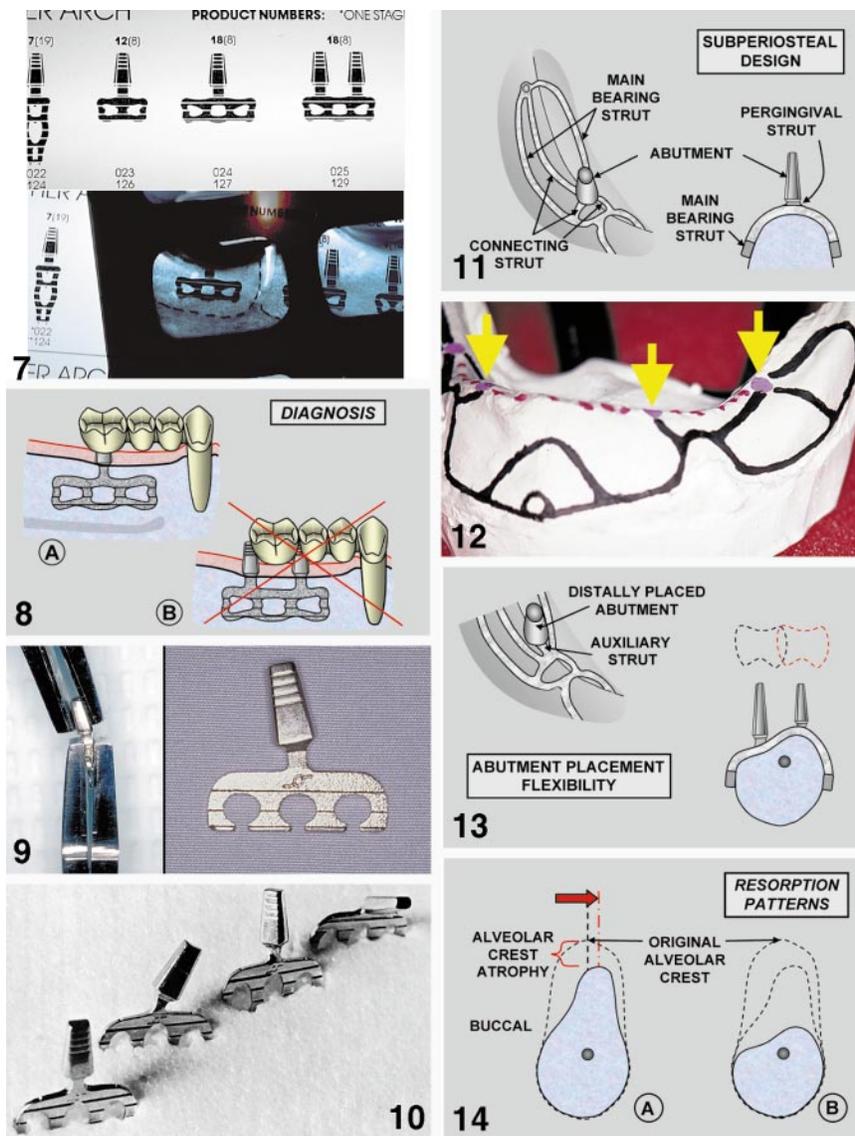


FIGURE 7. Optimal implant selection maximizes prosthesis support.

FIGURE 8. For a given prosthesis, correct plate/blade form abutment head selection for the same implant body in the same location is important.

FIGURE 9. One-stage plate/blade forms are easily adjusted for parallelism.

FIGURE 10. Examples of bending options to achieve parallelism.

FIGURE 11. Component struts of a subperiosteal implant.

FIGURE 12. Subperiosteal implant abutment head positioning.

FIGURE 13. Left: Auxiliary strut allows distal placement of abutment head for improved prosthodontics. Right: Abutment heads may be placed in a variety of positions bucco/labio-lingually along a connecting strut for improved prosthodontics.

FIGURE 14. Ridge crest changes during progressive resorption of alveolar bone.

ty of abutment support.^{14,15} Note that, commonly, one plate/blade form, with natural tooth or implant coabutments, can support several teeth of a fixed prosthesis. In several configurations,

implants with either one or two abutment heads over the same body configuration are available to accommodate prosthodontic requirements (Figure 8). A plate/blade form configuration may

have one abutment head located centrally over the implant body, two abutment heads symmetrically placed, or one abutment head placed off center, all with the same configuration of implant body below. This allows the practitioner to achieve the most optimal position of the abutment head(s) under the planned prosthesis. Areas destined to become embrasures can be avoided.¹⁶ In any event, the abutment need not be centrally located under the crown.

As in the case of root forms, the labio/bucco-lingual position of the ridge crest and thickness of overlying soft tissue are not limiting factors.

The abutment head configuration is not a limiting factor. The plate/blade form is the only modality that can heal and function in both the osteopreservation and osseointegration modes of tissue integration.¹⁷ To achieve the desired mode of tissue integration, the practitioner employs either one-stage sequencing with hypofunctional healing or two-stage submerged or semisubmerged sequencing with afunctional healing. Both of these options are routinely ridge lapped successfully. Two-stage plate/blade forms are fabricated with an external threaded protrusion from the implant shoulder and supplied with a stage I healing collar for use in submerged or semisubmerged afunctional healing and a stage II universal abutment head for fixed restoration. In the one-stage configuration, fabricated from one solid piece of metal, the universal abutment head is contiguous with the implant body and is suitable for cement retention. A fixed prosthesis can be cemented or screw-retained over a two-stage universal abutment.

The abutment heads of one- and two-stage plate/blade form configurations have several features in common. They can be adjusted for parallelism by bending across the implant neck (Figure 9). These bending adjustments can be made both bucco/labio-lingually and mesio-distally. It is not uncommon to require abutment head rotation of an

angle of 60 degrees or more following adjustments for parallelism when the implant body is advantageously situated in the most optimal position within the available bone (Figure 10). In addition, the abutment heads on both one- and two-stage configurations for cementable final prostheses can be prepared by reducing abutment head height for more optimal interocclusal clearance. In this procedure, the abutment is treated like a natural tooth, using suitable diamonds under adequate water spray to alter the shape for optimal parallelism prior to final prosthodontic impressioning.¹⁸

Subperiosteal abutment positioning

In the case of unilateral, circumferential, or total subperiosteal implants, the entire implant is custom fabricated and cast of biocompatible metal. Master models are made by direct impressioning of surgically exposed bone or from models generated by computed tomography in stage I of the procedure. Then the entire implant, including its abutment-retention mechanism, is custom made according to one's preferred design. Ridge lapping overlying restorative crowns is only performed when the abutments are meant for a cement or screw-retained prosthesis. Removable overdenture-type prostheses are not applicable for ridge lapping.

The abutment can be ideally positioned mesio-distally under an overlying ridge-lapped crown. The struts involved in the design and fabrication of subperiosteal implants are main bearing struts (located against basal bone to absorb the primary forces of occlusion), connecting struts (to join main bearing struts to each other and give rise to pergingival struts), and pergingival struts (to pass through pergingival sites into the oral cavity) (Figure 11). Abutment heads are contiguous with pergingival struts. They are designed, waxed, and cast in consideration of the type of final prosthesis, modified by the articulation of the master model of bone and the opposing arch in centric relation.

Since an abutment head is contiguous with a pergingival strut, which arises from a connecting strut, determining the mesio-distal position of the connecting strut is important. There are two primary requirements. As a connecting strut passes from the buccal or labial main bearing strut to the lingual main bearing strut, it is more ideally placed over the area exhibiting the greatest amount of bone resorption.¹⁹ Subperiosteal implants are utilized when there is insufficient bone into which an endosteal implant can be placed. Connecting struts over resorbed bone are less likely to exhibit future dehiscence or substantial further resorption of the underlying bone.

From the mesio-distal point of view, total subperiosteal implant abutments heads are most ideally placed as follows: one under each planned cuspid ridge-lapped crown and one toward the mesial of each second molar area under the position of each planned molar ridge-lapped crown to be positioned over it (Figure 12). If these four areas already exhibit significant resorption, the connecting strut can be placed to serve its two functions ideally. If not, connecting struts are placed over the ideally resorbed areas and the implant design is adjusted by adding extension or auxiliary struts from them onto which pergingival struts with contiguous abutment heads are fabricated (Figure 13). These abutments can be fashioned to accept a cementable or screw-retained overlying prosthesis.

The bucco/labio-lingual position of the ridge crest is not a limiting factor. In the case of subperiosteal implants, the ridge crest position and anatomy are highly variable. In severely resorbed cases, the area that used to be at the location of the ridge crest can be actually more resorbed than the lingual bone bordering it (Figure 14). Despite any variation, the position of the implant's abutment heads from the bucco/labio-lingual point of view is determined by prosthodontic requirements for the position of each overlying ridge-lapped restorative crown.

Thus, depending on the relationship of the opposing arch of the case at hand, the bucco/labio-lingual position of the abutment head can be placed ideally along the connecting strut (Figure 13). This is a significant benefit.

The thickness of the overlying soft tissue is usually not a limiting factor. Most often, the resorption of ridge height dictating the use of a subperiosteal implant is sufficient to ensure that, no matter how thick the overlying tissue, there will be little interference with interocclusal clearance and abutment height to retain the overlying ridge-lapped crown restoration. Plastic surgery to increase interocclusal clearance and abutment height is performed if required (Figures 5, 6).

The abutment head configuration is not a limiting factor. Any cement or screw-retained fixed or semifixed abutment configuration can be fabricated as an integral part of a subperiosteal implant. Any configuration can be successfully ridge lapped.

THE DESIGN OF RIDGE-LAPPED CROWNS OVER IMPLANT ABUTMENTS

The following design considerations apply to ridge-lapping crown restorations over dental implant abutments of any accepted modality. Each modality functions successfully in a different mode of tissue integration or, in the case of plate/blade forms, in more than one. Ridge lapping is successfully performed with each of the three types of tissue integration. To survive long term, root forms require the osteointegration mode of tissue integration. Osteointegration is the mode of tissue integration around a healed functioning endosteal implant in which the prime load-bearing tissue at the interface is bone.²⁰ In treatment sequences controlled by the practitioner, plate/blade forms can successfully heal in the osteointegration or osteopreservation modes of tissue integration. Osteopreservation is the mode of tissue integration around a healed, functioning endosteal dental implant in which the prime load-bearing tissue at the inter-

face is a peri-implant ligament composed of osteostimulatory collagen fibers that diminish the functional force passed to the surrounding bone.⁶ Conventional subperiosteal implants heal in the periosteal mode of tissue integration. Periosteal integration is the mode of tissue integration around a healed functioning subperiosteal implant in which the prime load-bearing tissue at the interface is a sheath of dense collagenous connective tissue contiguous with the outer layer of the periosteum, which diminishes the functional force passed to the underlying cortical surfaces of basal and other supporting bone.

Histologic analysis of each type of tissue integration differs. These histologic variations and their interrelationships to physiologic function and case sequencing are now becoming more fully understood. They can all be successfully ridge lapped.

Step-by-step fabrication of ridge-lapped crowns over dental implants

The selection of the ideal vestibular curvature and location in the restored arch of each crown to be ridge lapped and of the underlying abutments (in multiunit cases) is a prime consideration (Figure 15). The exact position of the underlying implant abutment, although placed as ideally as possible, does not dictate the final positioning of the overlying crown. Remember that most endosteal abutments emerge lingual to where the incisal edges or central fossae of the natural teeth were when they were in position. Most often, one wishes to emulate the original position of the tooth both bucco/labiolingually and mesio-distally. Therefore, on the articulated master models, position teeth with no constraints other than those required for ideal aesthetics. Pretend that each tooth is a pontic on a fixed bridge. With aesthetics in mind, determine tooth width, length, vestibular contours, and gingival margin contours. This alone is a significant advantage over the emergent profile protocol.

When tooth position has been determined, the next step is to establish the details of gingival contour. If they exist, utilize mated natural teeth for guidance. For example, if one is restoring a central incisor and its mate is present on the other side, try to match it for height and contour mesio-distally (Figure 16). In multiple-unit cases where no mates exist (Figures 17–19), creativity, patient photos prior to tooth loss, and the like can be helpful. This is in every sense an artistic endeavor. Lip length and how the lips drape over the arch in the variety of facial expressions also come into play.

Final adjustments are made during the bisque-bake try-in visit. One must visualize the prosthesis during initial fabrication and then make final corrections clinically. One should provide for the possibilities of both major and minor adjustments. This is done by carefully waxing up the underlying metal coping in the area of the ridge lap by rendering it about 2 mm shy of the predicted contours of the ridge-lapped facial gingival margin, which will ultimately be of porcelain or resin, to allow for final contour alterations in the mouth without compromising aesthetics by exposing metal.

It is important to achieve the effect of growing through the gingiva. The ridge-lapped area of the crown restoration must look as nearly as possible as though it were a natural tooth. This is done through an understanding of the interplay of both light and shadow as the patient talks, laughs, and smiles broadly. The solution is made easier when the patient's gingiva is covered by the lip or cheek during most facial expressions. Lighting is directed at each tooth from multiple angles, and the contours of the porcelain or resin are adjusted to achieve the preferred effect (Figures 20, 21). The bulk of the ridge-lapped area should be a passive fit tapered to 0.5 mm off the gingival surface at the implant abutment pergingival site. The final edge of the ridge-lap gingival contour will be passively in contact without pressure to

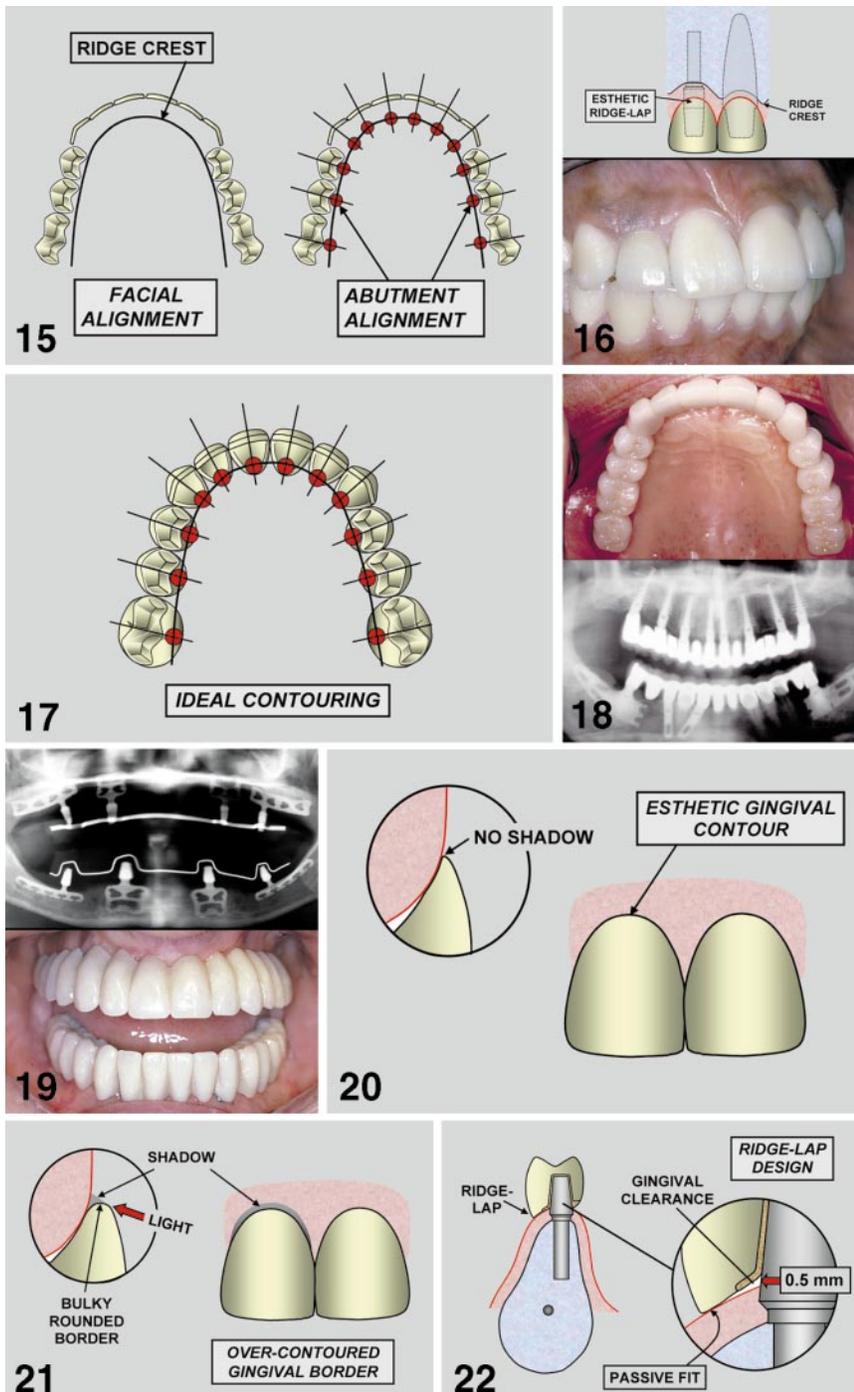


FIGURE 15. Left: Ideally positioned facial surface positioning regardless of ridge crest location. Right: Ideal positioning of root form abutments at the ridge crest.

FIGURE 16. Ridge-lapped restoration can match natural mate.

FIGURE 17. Ideal contouring of complete arch root form case.

FIGURE 18. Complete arch maxillary root form case.

FIGURE 19. Complete arch maxillary and mandibular plate/blade form case.

FIGURE 20. Well-contoured ridge lap appears to grow through tissue.

FIGURE 21. Slightly overcontoured ridge-lap border casts gingival shadow and compromises aesthetics.

FIGURE 22. Relationships among restorative casting, porcelain ridge-lap border, the implant abutment, and gingiva.

avoid creating a shadow (Figure 22). The final effect can be almost indistinguishable from that of a natural tooth.

The relationship of the tissue surface (saddle) of each crown to the underlying mucosa and the pergingival site is also important. When considering the tissue surface of a ridge-lapped crown, first determine the contours of its peripheral border, within which the saddle area is contained, and then the anatomic relationship of that saddle to the underlying mucosa and the pergingival site. When viewed from the mucosal aspect toward the incisal or occlusal surface, the facial border of the metal coping is determined as previously described by ending it 2 mm shy of the predicted gingival border contour. This necessarily encompasses the facial third of each proximal border as it turns toward the lingual. The facial margin of the coping at the implant abutment is placed at or 0.5 mm above the gingival crest at the pergingival site.

The lingual border of the periphery of the saddle is located by creating a knife-edge lingual margin on the metal coping being waxed over the protruding implant abutment, dictated by the location of the ridge crest in general, as well as the ability, within limits, to use a preferred area of available bone, even if it is not under the center of the overlying crown (Figure 4). At the operator's discretion, this margin can be placed at or above the gingival crest, or below it within the gingival sulcus.

The proximal border of the periphery of the saddle is also developed as a knife-edge margin against the most lingual two thirds of each proximal surface. This is contoured to promote ease of cleansing of the created embrasures and provision for implant papillae. The position of these margins relative to the gingival crest at the pergingival site is determined with considerations similar to those outlined above. The remainder of the coping is waxed to be acceptable for a porcelain or resin-to-metal final fabrication. If a screw-retained prosthesis is planned,

all customary requirements to achieve this, insofar as they relate to the cast underlying coping, are incorporated now. Again, the wax-up will be 2 mm shy at the ridge-lapped margin to permit adjustments for aesthetics.

With the peripheral aspects of the saddle now determined, the anatomic relationship between the tissue surface of the ridge-lapped portion of the saddle and the underlying mucosa is now determined.

The tissue surface of the ridge-lapped area along the facial border and one third of each proximal is kept 0.5 mm off the mucosa at the abutment, tapered to a passive fit at the periphery of the ridge lap (Figure 22).

Ridge-lapped crowns fabricated over dental implant abutments according to these guidelines are predictably aesthetic and cleansable. The pergingival site remains healthy long term.

CONSIDERATIONS FOR RIDGE-LAPPING CROWNS DURING THE BISQUE-BAKE TRY-IN

The bisque-bake try-in visit is the first time that all the decisions made according to the previous guidelines can be checked and adjusted clinically to ensure and enhance results. In addition, the patient should be thoroughly instructed in conventional home care procedures, with emphasis on flossing and flushing under the ridge lap. The following should be checked at this time and adjusted if necessary:

- lip and cheek contours to determine accuracy of the chosen arch curvature
- gingival contour for aesthetics
- possible need for closer adaptation to the ridge-lap periphery following contour adjustments to avoid undesirable shadows in varied light conditions
- facial anatomy of the crown to conform with matching of paired teeth and evenness of line-up
- proximal contours to accommodate papillae

- embrasures for aesthetics and cleansability
- proximal and labial margins of the casting
- possible adjustments related to color and its gradations
- occlusion
- relationships of tissue surface of the saddle to underlying mucosa
- margins and embrasures for ease of professional maintenance
- ability to utilize Hydro-Floss, dental floss, proximal brush, and rubber tip for cleansability.

DISCUSSION

The treatment advantages of ridge-lapping restorative crowns over dental implant abutments are significant. One can create the desired aesthetic result in almost every case. This can be achieved even when the implant abutment is not centered under the crown. No gingival grafting is required. No bone grafting is required. No ridge height reduction is required. No additional surgical procedures are required. Extended treatment time is not required. A more ideal occlusion can be achieved. Aesthetic changes in gingival crestal levels over time are shielded by the ridge lap, ensuring continuous longer term stability of the aesthetic result. Substantial iatrogenic gingival pockets associated with emergent profile protocols are not formed because substantial gingival thickness is not required. Long-term health at the pergingival site is routinely observed. The technique of ridge-lapping implant abutments has been utilized successfully worldwide for several decades. The long-term use and large number of cases comprise evidence of its efficacy. Patient and professional maintenance are easily accomplished.

Why then is this treatment technique controversial? There is a prevalent, unjustified negative mind set regarding the ridge lapping of crowns over implant abutments.^{12,21} Many practitioners believe that the technique simply doesn't work. Many of them have never performed treatment with ridge lap-

ping. Clearly, the source of concern is the fact that attempts to ridge lap crowns over natural teeth may cause pathology, even when the area is cleansable. It has been postulated that the cementum overlying the natural tooth root and the Sharpey's fiber insertions within it at the crestal areas of the periodontal ligament contribute to this inability. Research has shown that certain endotoxins that easily embed in cementum may also contribute to a pathologic process around natural teeth.²²

However, perhaps due to the absence of cementum, this is not true of the tissues at the ridge lap of crowns placed over dental implant abutments. They clearly do function long term in health.

Another factor that may account for the false perception that ridge lapping is unsuccessful over implant abutments may be the early inability to employ this method over root form implants, which were almost always in unattached gingiva. The recent evolution of root form techniques has resulted in an increase in the incidence of facial pergingival sites in attached gingiva, which helps to overcome this problem.

Ridge-lapping crowns overlying dental implant abutments can substantially increase the utilization of dental implants across the board, particularly for both single and multiple-tooth anterior prosthodontics. Consider that a great number of implant overdentures are fabricated precisely to avoid the difficulties and unpredictability of establishing aesthetics utilizing emergent profile protocols. In cases of splinted and unsplinted implant abutments supporting overdentures, where much more debris collects, professional and home care maintenance is successful, although usually more difficult than for ridge-lapped abutments. In the final analysis, the key to greater acceptance of the aesthetic ridge lapping of implant abutments is the long-term predictability of pergingival health in function.

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Editor's note: After reviewing comments from reviewers, Dr Weiss adds: I am not aware of any studies that investigate the efficacy of ridge lapping per se or, for that matter, that of emergent profile treatment. There are no published long-term studies that focus on either of these methods of aesthetic enhancement. Actually, we know more about the long-term effectiveness of ridge lapping than we do about the emergent profile technique because it's been in use so much longer. As stated in the article, ridge-lapping root forms was the only aesthetic restorative option available for fixed prostheses without flanges aside from overdentures. Thus, ridge lapping was performed in most of the seminal root form reports that predate the mid-1990s. The article references some of these studies and some textbooks related to root forms in this regard.

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