

# Restoring Mandibular Anterior Teeth with Porcelain Laminate Veneers and other Restorations

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## ABSTRACT

Patients are keeping their natural teeth longer, and the normal sequelae of human facial aging cause an increase in display of the mandibular anterior teeth. The design protocol for mandibular anterior restorations is quite different from maxillary anterior teeth.

This article defines and emphasizes these important differences and presents rules and rationale for successful fabrication of natural appearing, functional restorations for mandibular anterior teeth. A review of the key anatomical, functional and esthetic factors is included.

**Keywords:** Incisal edge, Incisal embrasures, Viewer's perspective.

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## INTRODUCTION

There are a vast number of articles and case reports presenting the use of porcelain veneer restorations in the dental literature today. A literature search reveals thousands of citations for porcelain laminate veneers, but nearly all describe the use of these restorations for maxillary anterior teeth, very few for mandibular anterior teeth. Those dentists and dental technologists seeking to learn how to fabricate porcelain veneer restorations specifically for mandibular anterior teeth might assume that the preparation and restorative design for mandibular anterior teeth would be relatively the same as for the maxillary. This is an unfortunate assumption, as key anatomic, esthetic and functional requirements for the

mandibular anterior teeth are actually quite opposite those of the maxillary anterior teeth.<sup>1</sup> Both the tooth preparation and restoration design are greatly influenced by these requirements.

When maxillary anterior restorative design criteria are used to fabricate mandibular anterior teeth, the resulting restorations are often unnatural in appearance, which is a source of frustration to the clinician and technician. (Figs 1A to D). More elder patients around the World have retained their natural teeth<sup>2,3</sup> and, due to the realities of facial aging, are displaying their lower anterior teeth more often.<sup>4</sup> It behooves the dentist and his/her chosen dental laboratory technologist to learn how to accurately and confidently restore these teeth when needed.

The purpose of this article is to demonstrate the essential anatomic, esthetic and functional aspects of the mandibular anterior teeth needed to properly prepare and restore them with natural appearing, durable porcelain veneer (or other) restorations. These important considerations can be grouped as follows:

- Anatomic/morphologic
- Functional/occlusal
- Esthetic/cosmetic (shading and visual presentation).

Each of these categories will now be described and punctuated with diagrams and actual clinical case presentations. Once the anatomically derived observations and fabrication rules are digested and put to clinical use, one should find that restorations for the mandibular anterior teeth are actually easier and more predictable to fashion successfully than those for maxillary anterior teeth.

## ANATOMIC/MORPHOLOGIC CONSIDERATIONS

The mandibular central incisors are the most highly bilaterally symmetrical teeth in the human dentition and the mandibular lateral incisors are next in progression (Fig. 2). The mandibular canines are much more 'incisoform' than the maxillary canines and the mandibular first premolars are considered by dental anatomists as part of the anterior, not posterior, group as 'form follows function'. The functional position of the mandibular canines in the 'normal' occlusion of man (Angle's class I) interdigitates them between maxillary canine and lateral incisor, while

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**Figs 1A to D:** This patient has a very sophisticated restoration of her lateral and central incisors supported by one dental implant (A and B). But because the dental technician wrongly carved an embrasure into the labial aspect between the two teeth, the observer sees 'picket fence' not natural teeth (C and D)

the mesial half of the mandibular first premolar articulates with the maxillary canine (Fig. 3).

Average width dimensions of the mandibular anterior teeth reveal only a  $\frac{1}{2}$  mm difference between central and lateral incisors and only 1 mm difference between the lateral incisors and canines. From the all-important viewer's perspective (those observing our patients teeth and restorations) these differences are too small to discern at normal viewing distances (2–4 feet). The approach recommended here is to make the widths of all 8 mandibular anterior teeth the same.

We see the proof of this important concept whenever a single mandibular anterior tooth is missing and the spaces are closed. The monotony of serial similar shapes fools all but the most expert observer usually a dentist. This visual continuum is only found in the mandibular anterior teeth, never in the maxillary (Fig. 4).

Complimenting this morphological phenomenon of repeating width equality is similar length. Shortly after adult tooth eruption and the onset of normal incisal function in the class I occlusion, the mamellons quickly wear away leaving the widest part of the mandibular incisors at the incisal edge (Fig. 5). Thus, there can be no incisal embrasures from tooth to tooth at the labial aspect.<sup>5</sup> The

dentist or dental technologist who wrongfully places incisal embrasures in mandibular anterior restorations usually creates an artificial, undesirable 'picket fence' appearance (Figs 1A to D).

The normal emergence profile angle of the mandibular central incisor is  $22^\circ$  from horizontal, the lateral incisor  $23^\circ$  and the canine is  $12^\circ$  (Fig. 6).<sup>6</sup> As the patient opens to speak, take in food or breathe, the entire incisal edge of at least the mandibular incisors and canines should be on complete view to the nearby observer. Thus the most important focal point of any mandibular



**Fig. 2:** The natural bilateral symmetry of the mandibular central incisor (after Kraus, Jordan, Abrams. Dental Anatomy and Occlusion)

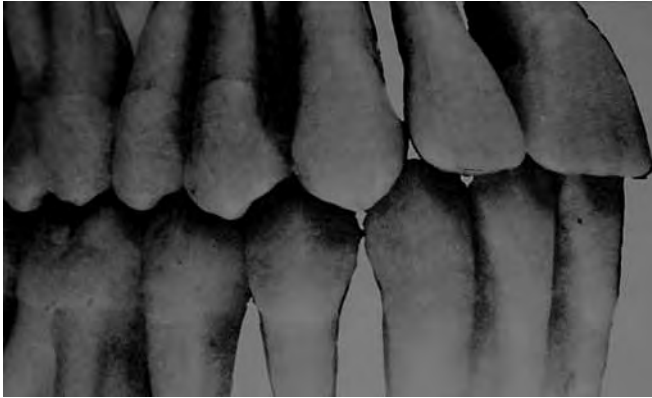
anterior tooth or restoration is the entire incisal edge, from labial to lingual border (Fig. 7). Successful rendering of the incisal edge requires careful copying in shape, size, color and surface morphology, of the natural adjacent teeth, if present, or of examples of other natural, attractive, mandibular anterior teeth, not maxillary. Since attractive, natural maxillary incisal edges are rarely if

ever on visual display, they are not acceptable substitutes (Figs 8A to G).

It is the structural components of the mandibular anterior incisal edge that need to be understood to render them accurately. The incisal edge of the young mandibular anterior tooth is uniformly covered with enamel with no dentin display. As natural wear occurs, a dentin-colored 'crease' appears in the middle of that area defined as the incisal edge, ending at the peripheral enamel wall. As wear progresses, more dentin will become exposed but the peripheral enamel rim is never violated (Figs 9A and B). The outline shape of the incisal edge also changes as attritional wear progresses as described by Abrams.<sup>5</sup> This follows the cross-sectional anatomy of the tooth.

### THE 'SORE THUMB' PHENOMENON

Just as swelling and redness of only one of our five fingers makes it the focal point of anyone looking at our hand, any major disturbance in the series of 8 level, bilaterally symmetrical shaped mandibular anterior teeth is easily seen. This often destroys the overall esthetic illusion of a new restoration. The overriding rule of



**Fig. 3:** The positions of the mandibular canine and 1st premolar in function with the maxillary teeth in the Angle's class I occlusion. (after Kraus, Jordan, Abrams. Dental Anatomy and Occlusion)



**Fig. 4:** Clinical patient with missing mandibular central incisor. Not readily apparent to the observer because of the fundamental similarity of the mandibular anterior teeth



**Fig. 6:** Natural incisors and canines set at normal angles of emergence (after Kraus, Jordan, Abrams. Dental Anatomy and Occlusion)

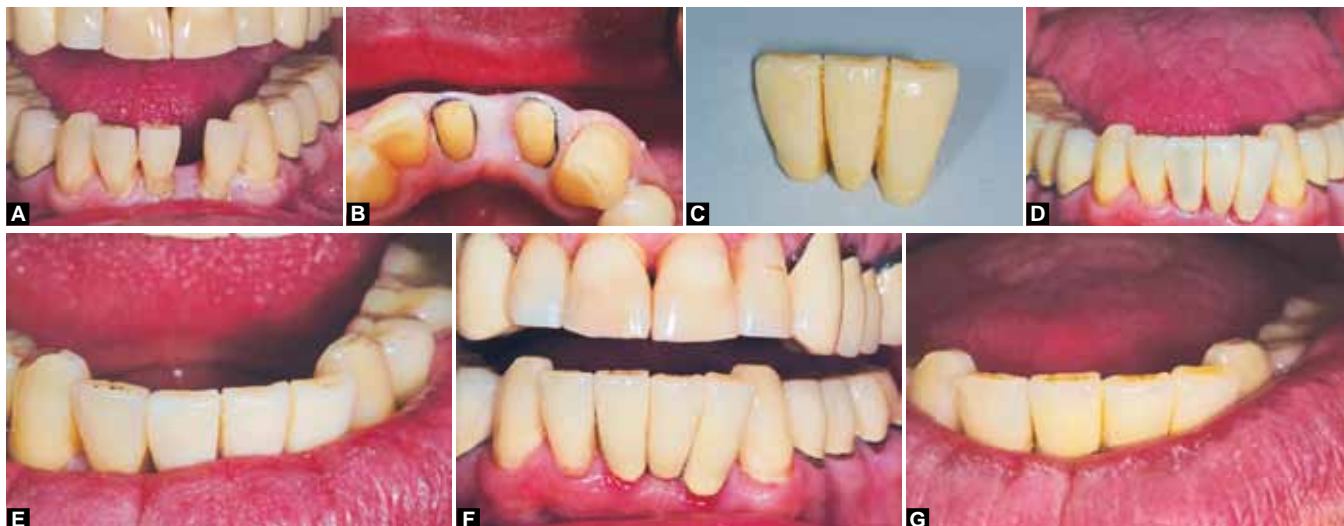


**Fig. 5:** Illustration of the absence of incisal embrasures on the labial of mandibular incisors



**Fig. 7:** Illustration of the dominance of the incisal edge in the presentation view of mandibular anterior teeth





**Figs 8A to G:** This patient lost his mandibular left central incisor and had a dental implant placed (A and B). Unfortunately, the implant failed necessitating the fabrication of a fixed dental prosthesis. Tooth preparations and provisional restoration (C to E). The three dental restorations are designed to mimic the shape and size of the remaining right lateral incisor resulting in four bilaterally symmetrical shapes of equal width. The all-important incisal edge display (F). The dental laboratory technologist uses the specifications of the provisional restoration to fabricate the final restoration (G)

fabrication for natural appearing mandibular anterior teeth then, is to strive to make them all look the same. This rule would never apply to a natural composition of maxillary anterior teeth.

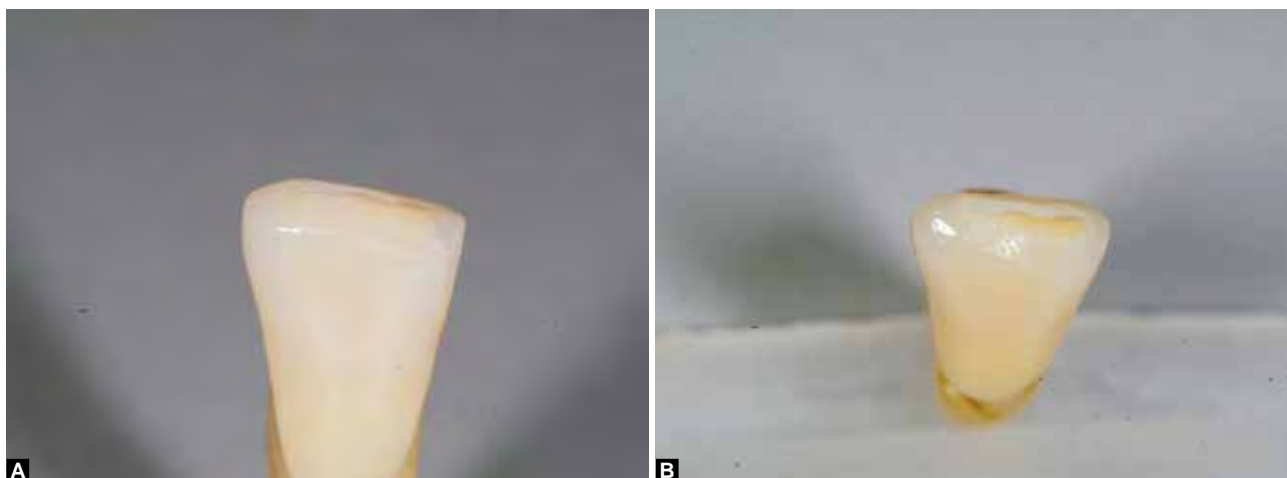
### FUNCTIONAL/OCCLUSAL PERSPECTIVE

In the normal, physiologically or therapeutically functional occlusion, the mandibular anterior teeth are firmly contained (anterior coupling) within the maxillary anterior teeth. They should be in light to moderate contact in the maximal intercuspal position, and in various degrees of contact in lateral and protrusive movements.<sup>7</sup> This defines a confined space for preparation and restoration (Fig. 10). Function against the lingual surfaces of the maxillary anterior teeth produces the characteristic functional outer aspect present across all these teeth<sup>6</sup> (Fig. 11). It is reflected in the angle of the incisal edge (Fig. 12).

These functional/occlusal factors dictate many aspects of the preparation design for restoring mandibular anterior teeth. One and a half to two millimeter uniform incisal but joint reduction (no lingual bevel or overlap) is recommended<sup>8</sup> (Figs 13A to F).

### ESTHETIC/COSMETIC PERSPECTIVES

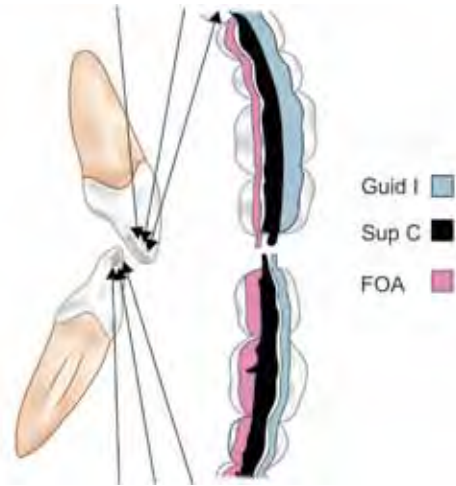
Very often the dentist is seeking to increase the overall incisogingival length of the maxillary anterior tooth for enhanced esthetics in porcelain veneer restoration. This is quite effective for patients seeking a more youthful smile, and impacts the amount of incisal reduction needed for the preparation. But, unless the patient has localized tooth fracture or other damages, it is rarely possible to lengthen mandibular anterior veneers without necessitating opening of the occlusal vertical dimension and harmonious posterior restorations. The one and a half to two millimeter uniform incisal reduction for the mandibular anterior



**Figs 9A and B:** Incisal edges of extracted natural mandibular incisors demonstrate the wear patterns described in the text



**Fig. 10:** The confined space available for the porcelain veneer preparation of the mandibular incisor, with the recommended reduction shown: One and a half to two millimeter at the incisal edge and no more than 0.5 mm for the body of the preparation. The goal is to preserve as much enamel as possible for reliable resin bonding



**Fig. 11:** The functional outer aspect (FOA) of mandibular teeth, most notably here the incisor (after Kraus, Jordan, Abrams. Dental Anatomy and Occlusion)



**Fig. 12:** Natural extracted mandibular incisor showing the functional inclination of the incisal edge

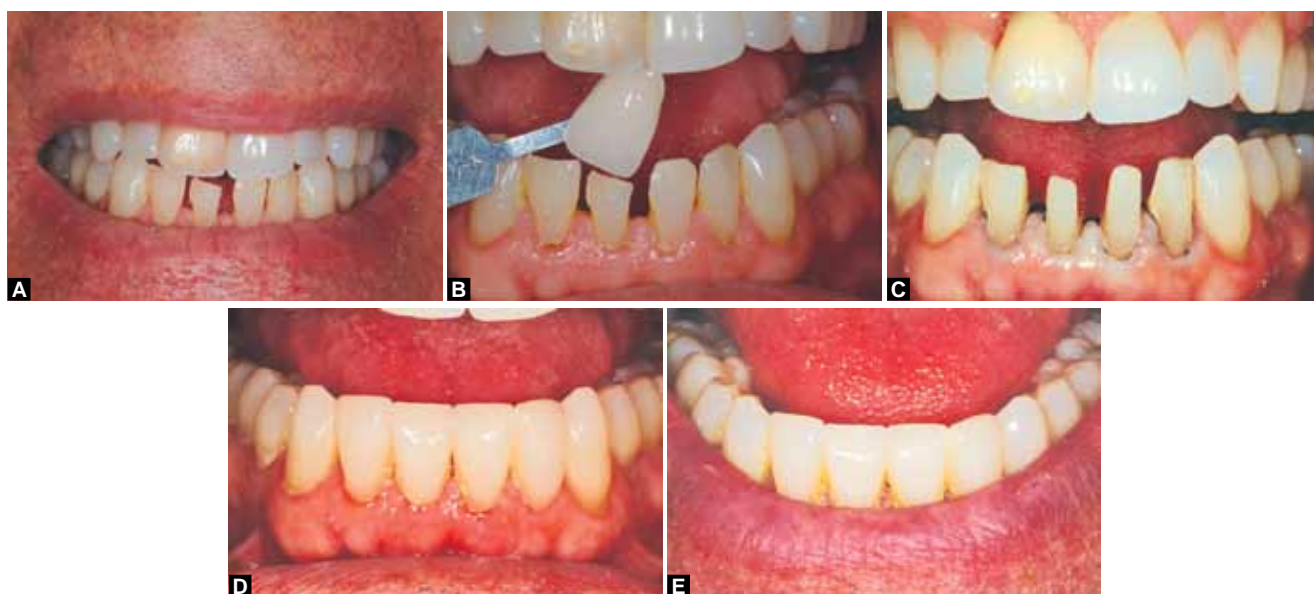
tooth porcelain laminate veneer preparation must be achieved for color and ceramic strength.

Natural rendering of the incisal edges with no labial incisal embrasures is critical to successful esthetic illusions for any mandibular anterior restorations. An accurate shade selected for the dentin influenced incisal edge needs special attention. Digital close-up photography is highly encouraged (Figs 14A to E).

With a solid comprehension of the rules and factors presented in this article, the dentist and dental technologist should find the challenge of restoring one single central incisor far easier and more successful in the mandibular anterior than in the maxillary (Figs 15A to C).



**Figs 13A to F:** This patient has a substantial coronal fracture of her mandibular right central incisor and repair with direct resin was attempted but failed (A and B). Tooth preparation for single porcelain veneer (C and D). Both the weakly bonded directly fabricated provisional veneer (E) and the fired porcelain final veneer (F) present an acceptable esthetic illusion/match because of the principles described in this article



**Figs 14A to E:** This patient presented with genetically narrow and locally chipped mandibular incisors (A and B). The atypical preparations (C) and final restorations in (D and E). The objective was to transform the unusual 'sore thumb' shapes of his natural teeth into a uniform set of continuous shapes harmonizing with his remaining lower anterior teeth (D and E)



**Figs 15A to C:** This patient fractured the entire labial enamel of her mandibular right central incisor (A and B). The single all ceramic crown restoration (C). The key feature in the successful esthetic restorative illusion is the detail of the incisal edge

## CONCLUSION

Rules and concepts for preparation and restorative fabrication of mandibular anterior teeth are quite different from those of maxillary anterior teeth. This information is not frequently found or used in the international dental literature. The principles presented here are based on sound anatomic/morphologic, and clinical observations.

The objective of this article is to help dentists and dental technologists create more esthetic and functional restorations of mandibular anterior teeth for their patients.

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