

# CAD/CAM techniques help in the rebuilding of ideal marginal gingiva contours of anterior maxillary teeth

## A case report

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**T**he contour of the marginal gingiva, referred to as “pink esthetics,” plays an important role in promoting a good appearance in the esthetic zone. Clinicians primarily use crown-lengthening surgery (CLS) to obtain enough biological width and to rebuild the contour of the marginal gingiva.<sup>1</sup> According to the principle of “biological width,”<sup>2</sup> the location of the alveolar bone is what determines the location of the marginal gingiva.



Supplemental material  
is available online.

Therefore, it is necessary to locate accurately not only the position of the marginal gingiva but also the alveolar bone position. Traditionally, periodontists have performed CLS by means of relying on what they could see with the naked eye; however, dentists may find it difficult to trim the marginal gingiva and the underlying alveolar bone precisely using this method. Thus, a precise template is a useful tool for this type of surgery. Dentists often make handmade surgery templates<sup>3,4</sup>; however, because they make the templates by means of using the naked eye, they cannot avoid making deviations in their templates. The 3-dimensional (3D)-printing technique is based on computer-aided design (CAD) and rapid prototyping (RP) technologies. In 2016, investigators reported that using the 3D-printing technique helped physicians improve the accuracy of their medical practice.<sup>5,6</sup> Dental clinicians have not used 3D-printing

## ABSTRACT

**Background and Overview.** “Pink esthetics,” which are considered to be as important as “white esthetics,” have attracted increasing attention. To date, clinicians rarely have applied computer-aided design and computer-aided manufacturing (CAD/CAM) techniques in the rebuilding of the contour of the marginal gingiva in the esthetic zone.

**Case Description.** In this case report, the authors describe a female patient who had gingival inflammation and an asymmetrical contour of the marginal gingiva of the anterior maxillary teeth because previously placed ceramic crowns violated the biological width. The authors used a 3-dimensional-printing surgery template to guide precise crown-lengthening surgery to expose subgingival shoulders and to obtain an ideal marginal gingival contour. Then the authors used interim CAD/CAM crowns to induce the growth of the interdental papilla by 0.5 to 1.5 millimeters. Finally, the patient had a symmetrical and well-balanced contour of the marginal gingiva. In addition, the authors reduced the patient’s “black triangle” areas to the greatest possible extent.

**Conclusions and Practical Implications.** This case report illustrates that CAD/CAM products, including 3-dimensional-printing surgery templates and CAD/CAM interim crowns, are helpful in shaping and rebuilding the ideal contour of the marginal gingiva in the esthetic zone, such as the anterior maxillary teeth.

**Key Words.** CAD/CAM; esthetics; crown lengthening; gingiva.

JADA 2017;■(■):■-■

<http://dx.doi.org/10.1016/j.adaj.2017.03.003>



**Figure 1.** Photo of inflamed gingiva on the patient’s anterior maxillary teeth at the first visit.

techniques widely in CLS. In a previously published study,<sup>7</sup> we established a method to make a 3D-printing template to guide clinicians in cutting the gingiva and trimming the alveolar bone. We found that using a 3D-printing template could help clinicians obtain an ideal contour for the marginal gingiva.

The “black triangle” or “open gingival embrasures” is a kind of esthetic defect that can occur at the interproximal area owing to interdental papilla loss. Interdental papilla will fill completely the interproximal area (100%) if the distance between the top of alveolar bone and proximal contact is 5 millimeters or less.<sup>8</sup> On the basis of this theory, prosthodontists have tried to use interim crowns to induce the growth of interdental papilla to fill the triangle areas.<sup>9</sup> However, handmade interim crowns that have a rough cervical margin may not only do harm to the health of the gingival tissue but also may influence the contour of the marginal gingiva. In comparison with handmade crowns, crowns made by means of CAD and computer-aided manufacturing (CAD/CAM), which have a smooth cervical margin and precise cervical contour, will keep the gingiva free of inflammation and help shape precisely the contour of the marginal gingiva.

In this report, we describe the case of a female patient who had gingival inflammation and an asymmetrical contour of the marginal gingiva of the anterior maxillary teeth because the ceramic crowns had violated the biological width. To assist in the successful rebuilding of the patient’s marginal gingiva, we made a 3D-printing template and interim crowns by using CAD/CAM strategies. In our case report, we describe the fully digitized technique that we used to rebuild the contour of the marginal gingiva in the esthetic zone.

## CASE REPORT

The ethics committee of the Hospital of Stomatology, China Medical University, Shenyang, Liaoning Province,

China (2013 Ethics Check No. 12), approved this case report.

A 30-year-old female patient had red, swollen labial gingiva of the anterior maxillary teeth (nos. 11, 21, and 22); she reported that, 10 years previously, a clinician had treated these teeth by placing ceramic crowns. The patient was not a smoker and was in good physical condition. After the clinician had placed the ceramic crowns, the patient repeatedly experienced inflamed gingival tissue, and the tissue had been inflamed severely during the previous 2 years. At the first visit, we recorded the patient’s periodontal condition (Figure 1 and eFigure 1, available online at the end of this article) and performed a periodontal examination (eFigure 2, available online at the end of this article) by means of using the Florida Probe System (Florida Probe). We found that the labial subgingival shoulders were approximately 3.0 to 4.0 mm under the gingival margins, whereas the lingual shoulders were above the gingival margins. The splint restoration of the anterior teeth made it difficult for the patient to clean the interdental zone. The radiograph obtained of the anterior maxillary teeth indicated gross open margins of the restoration, which may have retained more dental plaque and contributed to the inflamed gingiva (eFigure 3, available online at the end of this article). In addition, the radiograph indicated that the endodontic therapy had failed (eFigure 3, available online at the end of this article).

**Treatment process.** We obtained informed consent from the patient before beginning therapy. The treatment procedures were as follows:

- We removed the fixed denture of the anterior maxillary teeth and performed initial full-mouth periodontal therapy. We carefully performed supragingival and subgingival scaling with ultrasonic instruments (Piezon Master 700, Electro Medical Systems) and Gracey curettes (Hu-Friedy) to remove the dental plaque and the calculus. At the same time, we debrided some of the granulation tissue of the inflamed gingiva. We also irrigated the gingival pockets with a 3% hydrogen peroxide solution to remove the residual calculus and soft tissue. Finally, we put an iodine glycerol agent into the pockets to inhibit the bacteria growth. We also provided the patient with instruction related to careful oral hygiene to teach her how to brush her teeth and use dental flosses and interdental brushes.

- We performed endodontic therapy on teeth nos. 11, 21, and 22 (eFigure 3, available online at the end of this article).

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**ABBREVIATION KEY.** 3D: Three-dimensional. C: Labial central sites. CAD: Computer-aided design. CAM: Computer-aided manufacturing. CLS: Crown-lengthening surgery. D: Labial distal sites. L: Lingual sites. M: Labial mesial sites. RP: Rapid prototyping.

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