

A technique for transferring a patient's smile line to a cone beam computed tomography (CBCT) image

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Fixed implant-supported prosthodontic treatment for patients requiring a gingival prosthesis often demands that bone and implant levels be apical to the patient's maximum smile line. This is to avoid the display of the prosthesis-tissue junction (the junction between the gingival prosthesis and natural soft tissues) and prevent esthetic failures. Recording a patient's lip position during maximum smile is invaluable for the treatment planning process. This article presents a simple technique for clinically recording and transferring the patient's maximum smile line to cone beam computed tomography (CBCT) images for analysis. The technique can help clinicians accurately determine the need for and amount of bone reduction required with respect to the maximum smile line and place implants in optimal positions. (J Prosthet Dent 2014;112:108-111)

Patients with mild gingival display (high smile) or patients with excessive gingival display (gummy smile) who seek fixed implant-supported prosthodontic treatment for multiple missing anterior teeth or all teeth in the edentulous arch present challenges.¹ When the natural gingival architecture (including the interdental papilla) is not preserved or easily regenerated after the teeth are lost, a gingival prosthesis is preferred to attain optimal dentogingival esthetics.^{2,3} The gingival prosthesis can help to restore ideal or esthetic tooth proportions and optimal prosthesis contour and can provide lip support if necessary.⁴ However, the junction between the gingival prosthesis and the natural gingival/mucosal tissues must not be visible during the patient's maximum smile, primarily because of the inability to accurately match the color of the prosthetic gingiva with the natural gingival/ mucosal tissues. This is true irrespective of the material that is used to fabricate the gingival prosthesis.⁵

Solutions for the management of such patients vary on the basis of the etiology of the gingival display and patient preference. One solution is to perform ostectomy procedures (formerly called alveolectomy) in order to systematically reduce the bone and reestablish the bony platform to be concealed underneath the lip during maximum smile.^{1,6} The bony platform should be at least 4 to 5 mm below the position of the lip during maximum smile to provide a safety factor for concealment. Implants can then be placed at this level so that the prosthesis-tissue junction is not visible during maximum smile.⁴ This principle is applicable for either maxillary or mandibular excessive gingival display.

Ostectomy procedures can be accomplished with surgical burs, chisels, piezosurgical bone saws, or reciprocating microsaws.^{1,6} To avoid inadequate or excessive reduction of bone, determining the precise location of the anticipated bony platform is necessary. Inadequate reduction of bone can lead to esthetic failures, inadequate prosthetic space, and a poor emergence profile (concave) of the definitive prosthesis. Excessive reduction of bone can result in the loss of available bone for an implant of sufficient length and risk encroaching on vital anatomic structures.^{1,6} Therefore, knowing the exact apical location of the patient's lip position during maximum smile can be valuable during treatment planning and subsequent implant surgery.

The purpose of this article is to describe a simple method of clinically

recording and transferring the patient's maximum smile line with cone beam computed tomography (CBCT) for analysis. The advantage of the presented technique is that it is simple and inexpensive and can be done chairside in a single clinical visit. The additional time spent on this technique yields invaluable information and eliminates speculation during treatment planning. Additionally, this technique can help orthodontists when CBCT is used for orthodontic diagnosis and planning.

TECHNIQUE

1. During the clinical examination, assess the patient's maximum smile line or most apical position of the lip (maxillary or mandibular) that is of clinical interest. Ask the patient to stretch the lips and generate an exaggerated smile to reveal as much gingiva as possible (Fig. 1).

2. For a dentate patient with a terminal dentition, fabricate a radiographic guide from a clear thermoplastic material (0.02 inches thick, 5×5 -inch Clear Temporary Splint Sheets; Patterson Dental) on the patient's diagnostic cast. For a partially edentulous patient, perform an appropriate diagnostic waxing before fabricating a radiographic guide. For edentulous patients,

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1 Maxillary gingival display in patient with terminal dentition due to chronic generalized periodontitis. Treatment plan involved maxillary extractions and fixed implant-supported prosthesis after ostectomy procedure and implant placement.



2 Maximum smile line marked with black marker on her clear radiographic guide. Whitish appearance in interdental areas is reflection of camera flash due to air between clear guide and teeth.



3 Frontal view showing extent of marking on clear radiographic guide. Marking can either extend to most posterior gingival display or terminate at area of interest to clinician. Whitish appearance in interdental areas is reflection of camera flash due to air between clear guide and teeth.

duplicate the patient's diagnostic denture in clear acrylic resin.

3. Insert the radiographic guide intraorally and ask the patient to generate an exaggerated smile to display maximum gingiva.

4. With the radiographic guide in the mouth, ask the patient to stretch the lips and generate an exaggerated smile to reveal as much gingiva as possible. Repeat a few times to record the most apical position of the lip. It is helpful if the patient is asked to close their eyes during maximum smile. Mark the lip position with a disinfected finetip marker (Expo; Sanford Ink Co) (Fig. 2). Note that the most apical position of the lip can be traced to the most posterior gingival region displayed by the lip or restricted to the clinician's area of interest.

5. Reconfirm that the marking is at the level or underneath the lip during maximum smile and then retrace the marking with the marker (Fig. 3).

6. Remove the radiographic guide and then scribe a small groove along the marked line with a slow speed round tungsten carbide bur (#4; Midwest Burs).

7. Extraorally, heat a gutta percha cylinder (Gutta-Percha Sticks; Dentsply Intl) and adapt it carefully along the groove. Use a wax spatula to seal the gutta percha to the radiographic guide (Fig. 4). Incorporate the gutta percha in the most posterior gingival region displayed by the lip or restrict it to the area of interest to the clinician (Fig. 5).

8. Replace the radiographic guide containing the gutta percha marker (or any other radiopaque marker) intraorally and obtain a CBCT scan with the appropriate field of view.

9. Transfer the images from the CBCT to an implant planning software program (Invivo 5; Anatomage) and analyze the maximum smile line represented by the radiopacity of the guttapercha with respect to the prevalent bone level (Fig. 6).

10. Determine the amount of ostectomy required from the radiographic treatment plan and transfer the information to the surgical guide and



4 Radiographic guide with gutta percha marker placed along scribed groove at area of black marking.



5 Frontal image showing radiographic guide with gutta percha marker.



6 A, CBCT image of cross-sectional slice (sagittal view) at right maxillary central incisor site. Note cross section of gutta percha marker to appreciate most apical position of maxillary lip during maximum smile in relation to existing bone levels. Image also shows frontal view of skeletal structure with gutta percha marker's position in relation to teeth and bone. B, Close-up view of cross-sectional slice (sagittal view) from CBCT made at level of right maxillary central incisor reveals anticipated implant position after planned ostectomy to reduce bone 5 mm apical to gutta percha marker. Adequate availability of bone below nasal floor provides implant stability for planned 10-mm implant.

proceed with surgery for systematic bone reduction and subsequent implant placement.

SUMMARY

This article described a straightforward technique for transferring the patient's most apical lip position during maximum smile to the radiographic images obtained with CBCT. Gutta percha markers were used on a radiographic guide to clinically record a patient's maximum smile line, and this information was then transferred to the CBCT images. This technique provides invaluable information to the clinician about the relationship of the patient's most apical lip position with reference to the residual ridge level. This helps to accurately determine the need for ostectomy procedures in order to place the implants apical to the lip position and allow adequate concealment of the prosthesis-tissue junction.

REFERENCES

- Bidra AS, Agar JR, Parel SM. Management of patients with excessive gingival display for maxillary complete arch fixed implant-supported prostheses. J Prosthet Dent 2012;108:324-31.
- Coachman C, Salama M, Garber D, Calamita M, Salama H, Cabral G. Prosthetic gingival reconstruction in fixed partial restorations. Part 1: introduction to artificial gingiva as an alternative therapy. Int J Periodontics Restorative Dent 2009; 29:471-7.
- Coachman C, Salama M, Garber D, Calamita M, Salama H, Cabral G. Prosthetic gingival reconstruction in fixed partial restorations. Part 3: laboratory procedures and maintenance. Int J Periodontics Restorative Dent 2010;30:19-29.
- Maló P, Nobre Mde A, Lopes I. A new approach to rehabilitate the severely atrophic maxilla using extramaxillary anchored implants in immediate function: a pilot study. J Prosthet Dent 2008;100:354-66.
- Bidra AS, Agar JR. A classification system of patients for esthetic fixed implant-supported prostheses in the edentulous maxilla. Compend Contin Educ Dent 2010;31:366-79.
- Jensen OT, Adams MW, Cottam JR, Parel SM, Phillips WR 3rd. The All-on-4 shelf: maxilla. J Oral Maxillofac Surg 2010;68:2520-7.

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