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# Key Factors in Treatment Planning for Complex Cases

## Orthodontics as a Tool to Manage Severely Worn Dentitions




Dr. Gerard Chiche will present “Esthetic Full-Mouth Rehabilitation” on Saturday, April 30, at AACD 2016 Toronto. In this course, he will outline the management of risk factors in a step-by-step method to maximize long-term success of complete rehabilitation, as was done for the complex case discussed in this article.

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### Abstract

Dentition that is worn from attrition or erosion presents many challenges. A comprehensive extraoral and intraoral examination should be performed to collect necessary data to create a treatment plan. This article covers key intraoral parameters when dealing with these complex cases. The case discussed illustrates an interdisciplinary plan to serve the patient’s needs and expectations, and provide biological and functional support for the final restorations.

**Key Words:** worn dentition, orthodontics, crowns, veneers, onlays



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## Introduction

The dental treatment of adult patients with high esthetic expectations can represent a challenge when they present with worn dentition from attrition or erosion. In addition, their typical chief complaint is that their anterior teeth are too short.<sup>1-3</sup>

To successfully establish a correct diagnosis, the clinical examination should begin with a comprehensive extraoral examination followed by an intraoral examination. Once the data are accurately collected, a treatment plan can be formulated.<sup>4-6</sup>

The patient's face should be evaluated with extraoral measurements, complemented with cephalometric radiographs and cone beam computed tomography (CBCT). These data help to identify any craniofacial abnormalities, such as vertical maxillary excess.<sup>7</sup> Then the patient's lip characteristics should be evaluated, including length and mobility and their relation to the patient's gender and age.<sup>8,9</sup>

Once the patient's extraoral features have been examined, an intraoral examination should be performed, consisting of clinical attachment level, probing depth, and radiographic bone level. Diagnostic tools include an explorer, periodontal probe, and radiographs to determine if the patient has excessive gingival display due to altered passive (gingival enlargement or pseudo pockets) or altered active eruption. Finally, tooth size and shape should be measured to determine how much tooth structure has been lost due to attrition, abrasion, or erosion.<sup>10-14</sup>

## Four Key Intraoral Parameters

If the facial thirds and lip characteristics have been deemed to be within pleasing and normal limits, the key elements that must be assessed for a proper diagnosis of intraoral features include cementoenamel junction (CEJ) location, root length and shape, tooth structure quantity and quality, and papilla level/contact length.

### I. Parameters

- A. CEJ location
  1. Where is it in relation to the bone?
  2. Where is it in relation to the soft tissue?
- B. Root length and shape
  1. Is there a favorable crown-to-root ratio?
  2. Is it round or triangular?
- C. Tooth structure quantity and quality
  1. How much tooth structure is available?
  2. How much enamel or dentin is available and what quality is it?
- D. Papilla level/contact length
  1. Papilla – maxillary anterior teeth
    - a. central incisor (papilla should be 41% of the length of the central incisor)
    - b. lateral incisor (papilla should be 41% of the length of the lateral incisor)
    - c. canine (papilla should be 43% of the length of the canine)
  2. Contact length – maxillary anterior teeth
    - a. central incisor (mesial contact area should be 40% of the length of the central incisor)
    - b. lateral incisor (mesial contact area should be 30% of the length of the lateral incisor)
    - c. canine (mesial contact area should be 20% of the length of the canine)



## CASE REPORT

A 61-year-old female wished to improve her smile and ability to chew. She presented with a severely worn dentition due to long-term intake of soda drinks, acid reflux, and protrusive bruxism (Figs 1-3). She also had severe headaches and the temporomandibular joint load test was positive. Pulse oximeter data revealed no signs of obstructive sleep apnea (Fig 4).

The patient was evaluated with oral measurements, periapical radiographs, a CBCT, and a maxillary anterior wax-up, and a mock-up with upper lip at rest was completed (Figs 5-8). These data helped to identify the following treatment plan and procedures:

1. Occlusal appliance therapy to determine the appropriate joint position, confirmed by comfort and negative load test (Figs 9a & 9b).
2. Orthodontic treatment to intrude maxillary and mandibular incisors (Figs 10a & 10b).
3. Bonded temporary restorations to facilitate orthodontic therapy (Figs 11a-14d).
4. Connective tissue graft to improve soft tissue (Figs 15a-15e).
5. After completion of the orthodontic treatment (Figs 16a-16c), a CAD/CAM evaluation for centric occlusion (CO) with an intraoral scanner (3Shape North America; Warren, NJ) (Figs 17a-17c) to determine the desired shade (Fig 18).
6. Creation of preparations with a minimally invasive prosthetic procedure (MIPP)<sup>15</sup> and a full-contour wax-up where the occlusion was refined (Figs 19-24c).
7. Restorative treatment with bonded e.max crowns veneers, and onlays (Ivoclar Vivadent; Amherst, NY) (Figs 25 & 26).
8. Occlusal guard post-delivery.

This interdisciplinary plan not only improved the patient's ability to chew but also achieved her esthetic desires. The final restorations in this complex case illustrate an improved smile and met the patient's wishes and hopes (Figs 27a-30b).



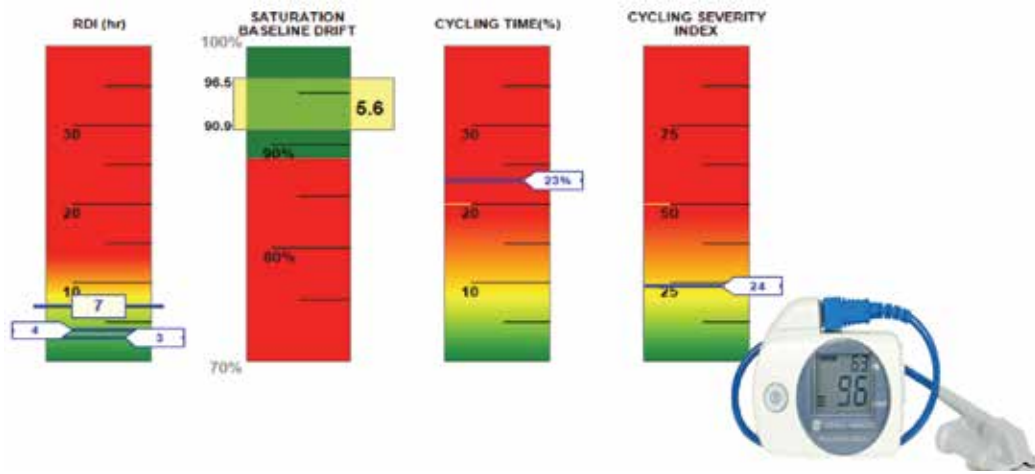
**Figure 1:** Preoperative extraoral image. There is no display of maxillary anterior teeth and 3 mm display of mandibular anterior teeth. The patient has thin lips.



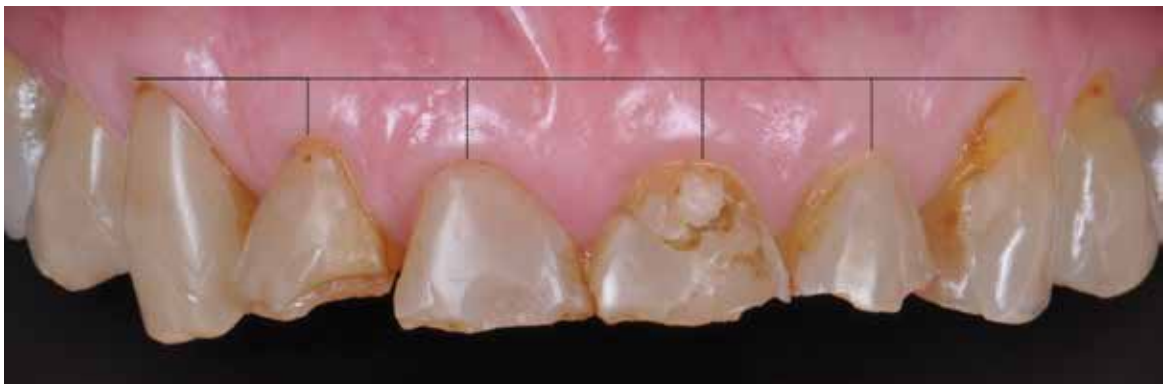
**Figure 2:** Preoperative smile image. Reversed smile line showing excessive mandibular display. The maxillary lip is asymmetric.



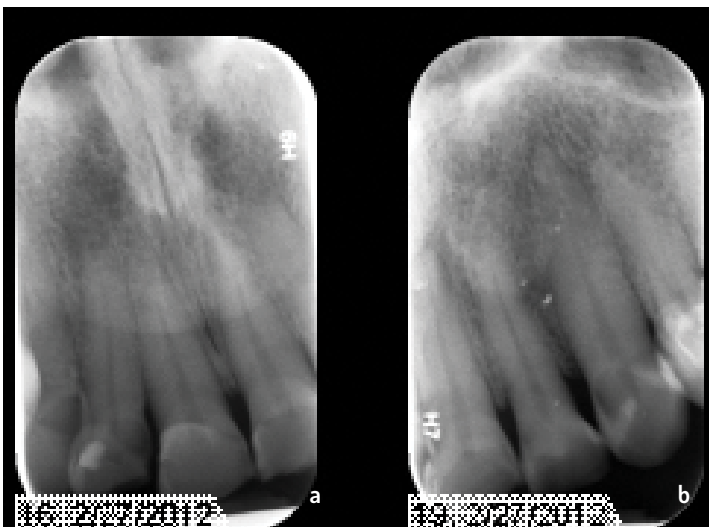
**Figure 3:** Preoperative intraoral image with severely worn dentition and edge-to-edge occlusion. Some teeth are eroded and have minimum contact with their antagonist. Maxillary and mandibular incisors are supererupted.



**Figure 4:** Pulse oximeter data revealed no signs of obstructive sleep apnea.



**Figure 5:** To determine how much the maxillary incisors have supererupted, a line is drawn connecting the gingival levels of canines. Normally, the gingival levels of the central incisors are expected to approximate this line.



**Figures 6a & 6b:** Periapical radiographs displaying short and conical shape roots of maxillary incisors.



**Figure 6c:** The CBCT section is also used to evaluate the distance between the CEJ and the crestal alveolar bone: It is 3 mm and it is also estimated that the facial enamel thickness is 1.5 mm, with no enamel present on the lingual aspect.



**Figure 7:** Maxillary anterior wax-up based on ideal tooth proportions and lingual ramp design; due to the severely worn dentition and its compensatory eruption, this lingual ramp design is critical for occlusal stability and prevention of orthodontic relapse.

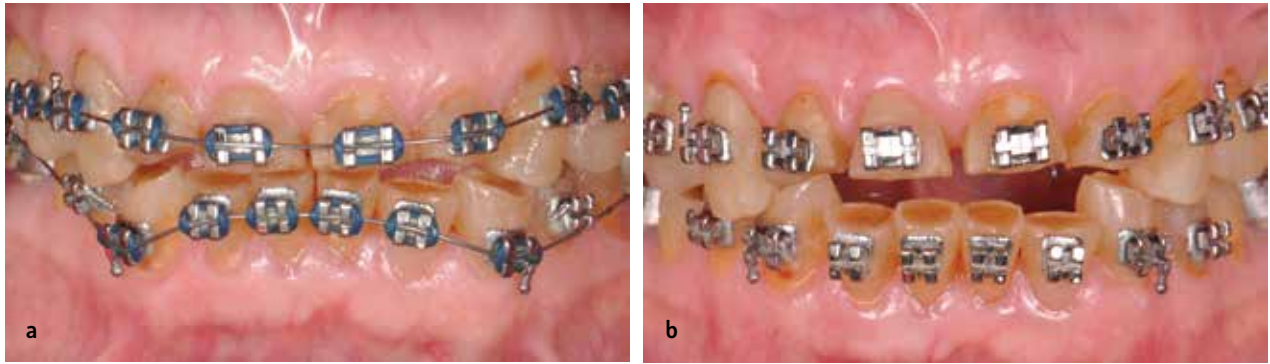


**Figure 8:** Evaluation of mock-up with the upper lip at rest. During this mock-up stage, "F" and "V" sounds should be evaluated. The maxillary incisal edge is esthetically pleasing and the mandibular incisal edge level was deemed satisfactory. To avoid incisal tooth reduction, it was decided that the mandibular incisors would be intruded 1.5 mm.

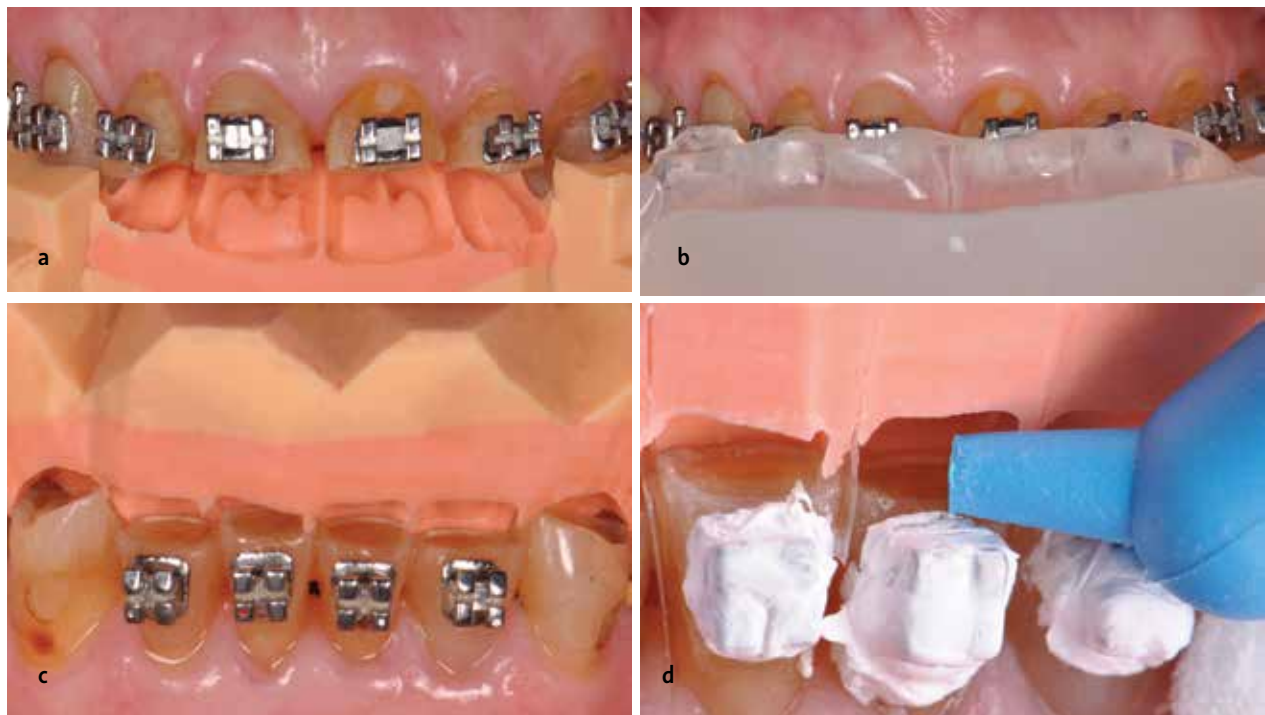


**Figures 9a & 9b:** Occlusal device fabricated to determine the optimum joint position. Since the patient displayed a positive load test, the mandible was repositioned anteriorly to a comfortable position. The TMJs were evaluated at regular intervals for six months until a final pain-free position was determined for the final reconstruction.

— The patient's face should be evaluated with extraoral measurements, complemented with cephalometric radiographs and cone beam computed tomography. —



**Figures 10a & 10b:** Intrusion of maxillary and mandibular incisors. Treatment objectives included a pleasing gingival plane, more conservative tooth preparations, and improved occlusion.



**Figures 11a-11d:** Direct composite restorations were fabricated during orthodontic treatment. They provided improved communication of final tooth position for the orthodontist.

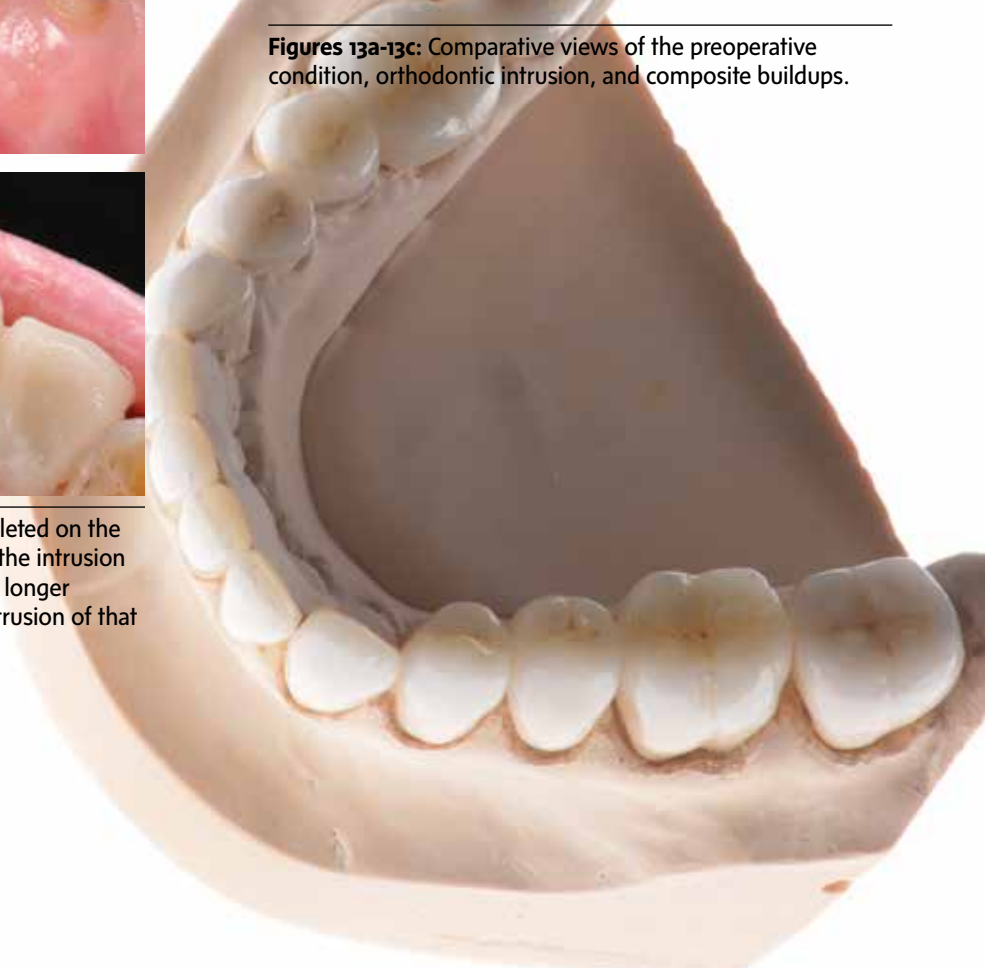
This interdisciplinary plan not only improved the patient's ability to chew but also achieved her esthetic desires.



**Figures 12a-12c:** Composite buildups were completed on the maxillary and mandibular anterior teeth during the intrusion process. The mandibular left central incisor was longer incisally to guide the orthodontist for further intrusion of that tooth.



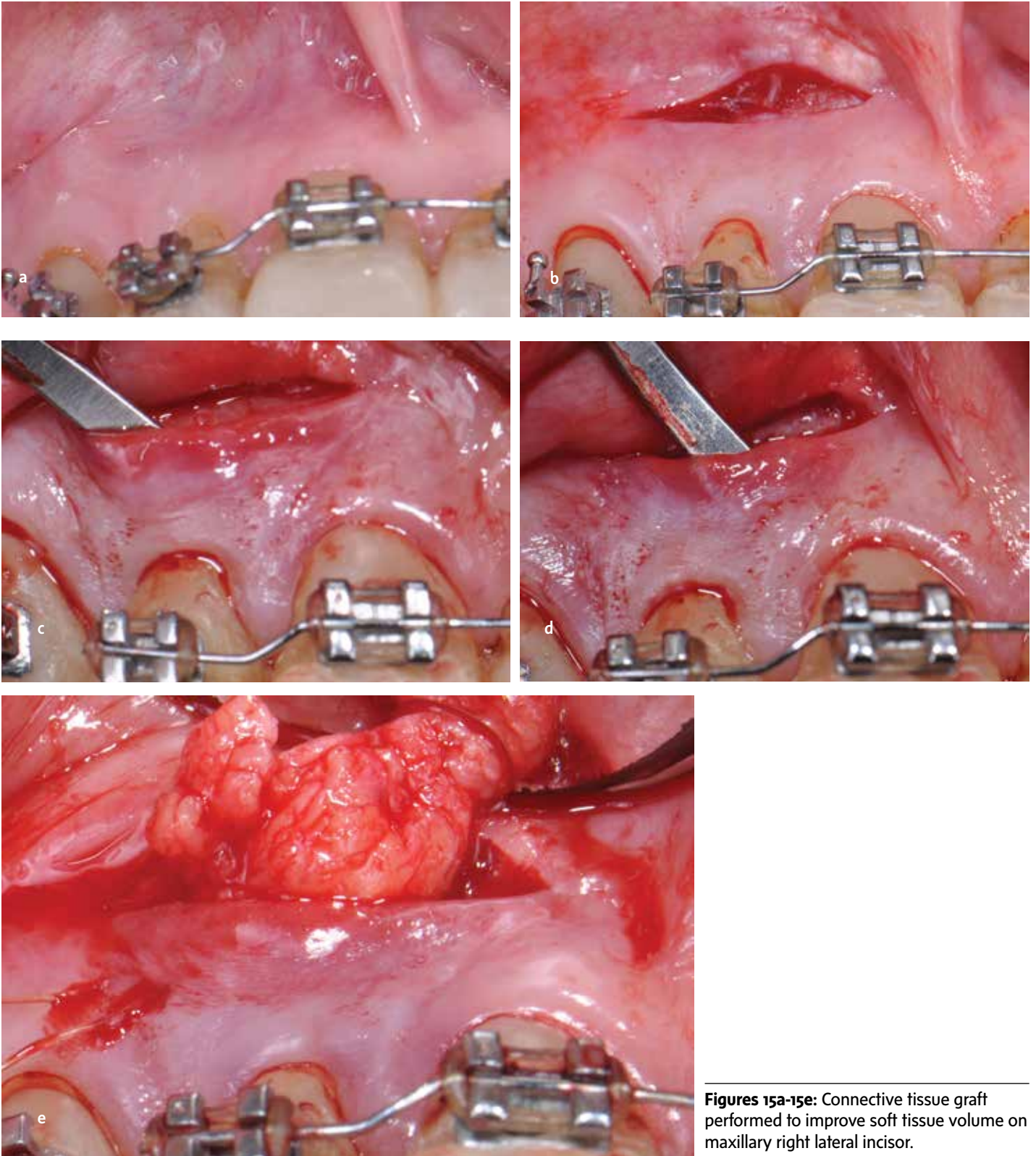
**Figures 13a-13c:** Comparative views of the preoperative condition, orthodontic intrusion, and composite buildups.







**Figures 14a-14d:** Posterior indirect composites were bonded individually.

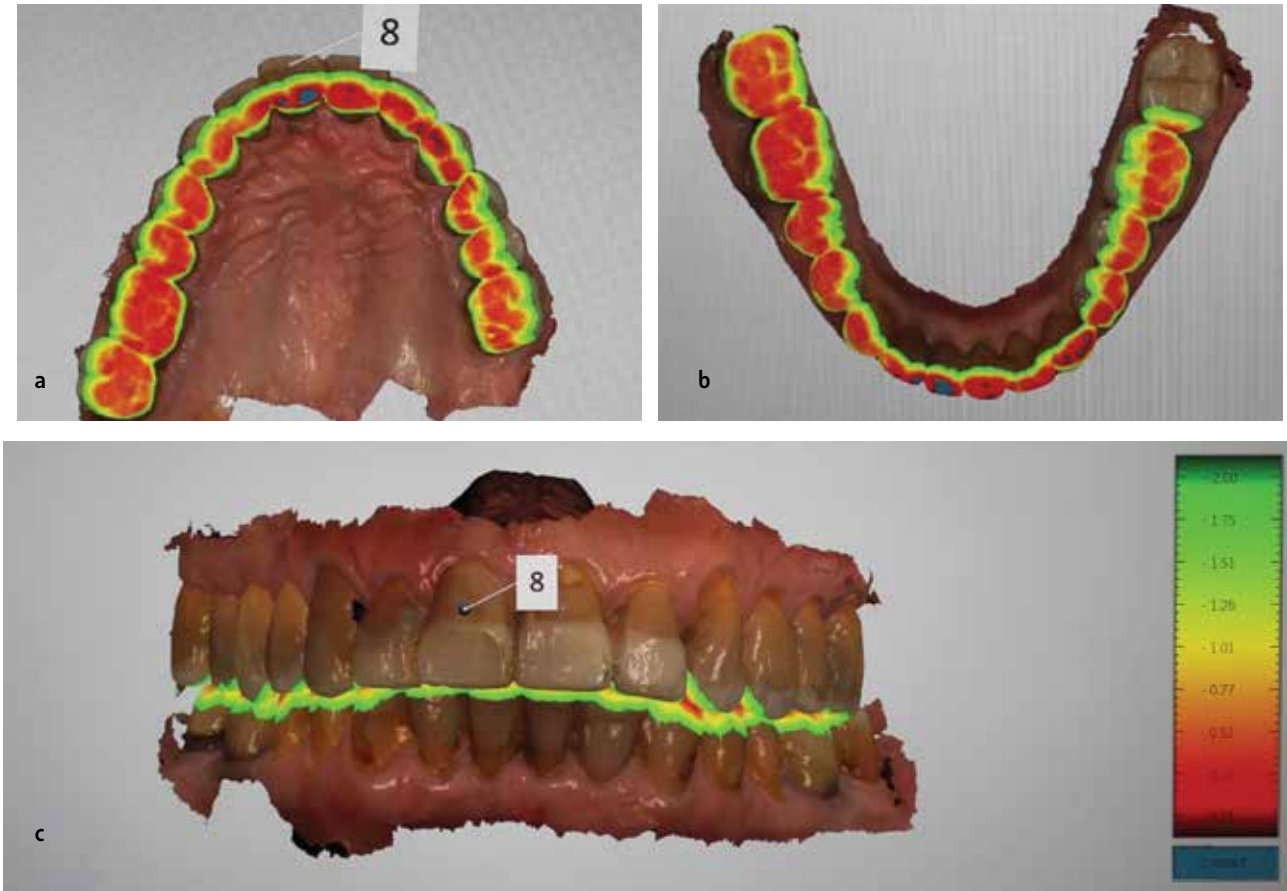


**Figures 15a-15e:** Connective tissue graft performed to improve soft tissue volume on maxillary right lateral incisor.



**Figures 16a-16c:** Completion of the orthodontic treatment. Tooth proportions were enhanced along with stable CO and anterior guidance.

Based on these findings, an interdisciplinary plan can be devised to best serve the patient's needs and expectations and provide the optimum biological and functional support for the final restorations.



**Figures 17a-17c:** CAD/CAM evaluation of CO. It was decided to equalize the strength of the contacts in the anterior and posterior teeth. The lingual ramp of maxillary anterior teeth is necessary to prevent subsequent extrusion of maxillary and mandibular incisors.



**Figure 18:** The desired shade was determined before removing the composites in order to decide on the depth of preparation and the material selection.



**Figure 19:** The magnitude of the depth guides of the final preparations was based on the expected shade of the restorative material.



**Figure 20:** Superimposition of the depth guides and the prepared teeth. The original incisal edges were left untouched.



**Figure 21:** The MIPP technique allows for minimum tooth preparations: conservative full-coverage crowns on the maxillary anterior teeth, porcelain veneers on the mandibular anterior teeth, and porcelain onlays on the posterior teeth.



**Figures 22a-22c:** The full-contour wax-up of the maxillary arch was based on esthetic and functional objectives to provide a stable posterior occlusion.



**Figures 23a-23c:** The full-contour wax-up of the mandibular arch was based on esthetic and functional objectives to provide a stable posterior occlusion.



**Figures 24a-24c:** The occlusion was refined in the wax stage before processing the pressed restorations.



**Figure 25:** Posterior onlays allow for conservative tooth preparation.





**Figure 26:** Final intraoral image with lithium disilicate crowns pressed and stained. Shade A3 was selected by the patient to maximize a natural appearance.



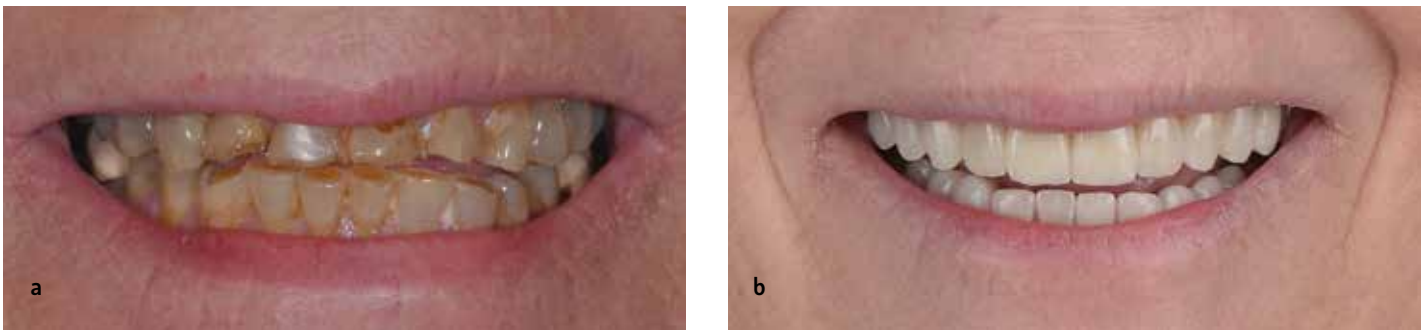
**Figures 27a & 27b:** Preoperative and postoperative images of the challenging worn dentition case.



**Figures 28a & 28b:** Preoperative and postoperative evaluation of the restorative maxillary treatment addressing the patient's concerns.



**Figures 29a & 29b:** Preoperative and postoperative images showing the mandibular transformation.



**Figures 30a & 30b:** Preoperative and postoperative images showing the completed treatment following the authors' key factors for comprehensive cases.

## Summary

Treatment-planning decisions for comprehensive cases often involve selecting either surgical crown lengthening or orthodontic intrusion or a combination of both. The final selection depends upon the following key factors:

- CEJ location
- root length and shape
- tooth structure quantity and quality
- final papilla location and desired proximal contact location.

In addition to the above intraoral parameters, the best indicated type of restorative material (etchable or non-etchable ceramics) and the preparation design also are critical to success. Based on these findings, an interdisciplinary plan can be devised to best serve the patient's needs and expectations and provide the optimum biological and functional support for the final restorations.

## Acknowledgements

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