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ESTHETICS

Bioesthetics: *The Study of Beauty in Life*

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Bioesthetics examines the three complexes of dental, dentofacial, and facial to transform oral functional and esthetic problems into beautiful, natural-looking smiles.

Today, successful functional and esthetic dentistry consists of mastering a thorough understanding of natural unworn tooth morphology and tooth positions, and how this relationship influences the dentofacial and facial complexes.

This article discusses the concept of bioesthetics and how this discipline, coupled with a thorough understanding of the interrelationships between function and objective aesthetics, can result in successful rejuvenations that are not only functionally correct but are esthetically pleasing.

Dental Bioesthetics

Bioesthetics focuses on all three complexes, with



Figs. 1 and 2. There has been a tremendous change in facial mask to sensitive changes to vertical dimension of occlusion.



Fig. 3

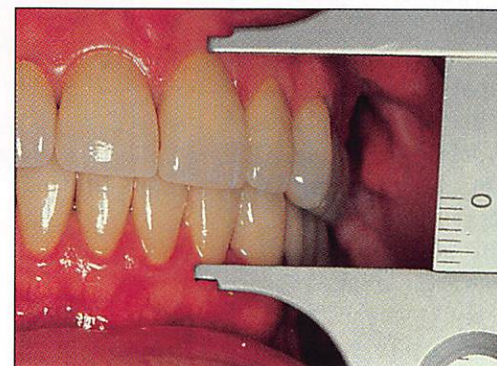


Fig. 4

the goal of maximizing the anterior guidance and verticalizing the posterior segment. This results in a

minimization of the influence of condylar guidance on the morphology of the posterior teeth. The occlu-

sal scheme is accomplished in two ways: Proper axial inclination of the anterior teeth; and correct overlap,

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1mm to 2mm, and overbite, 3mm to 4mm.^{1,2} This facilitates the guidance of the posterior teeth with the condyles in centric relationship.

Williamson stated that the elevating activity of the temporal and masseter muscles could be reduced only when posterior guidance is obtained by an appropriated anterior guidance. It is not the contact of the canines that decreases the activity of the elevator muscles, but elimination of posterior eccentric contacts.^{3,4,5} Centric relation may be defined as any place along the arc of closure where the condyles are bilaterally in their most superior, anterior and medial position in intimate contact with the thinnest part of the biconcavity of the disk. It is also acceptable to re-establish vertical dimension.^{2,6} The positioning and design of the anterior segment and its relationship to the posterior segment will be developed to expand this premise.

Complexes

The three complexes of the facial (Fig. 1, Fig. 2) dentofacial, pertaining to the teeth and lips (Fig. 11 & 12), and the dental, or teeth (Fig. 15 & 16) are directly correlated.^{4,7,8} These complexes are like a hologram, totally interconnected.

Facial Complexes

Dentists are hard-tissue plastic surgeons.⁹ Dr.

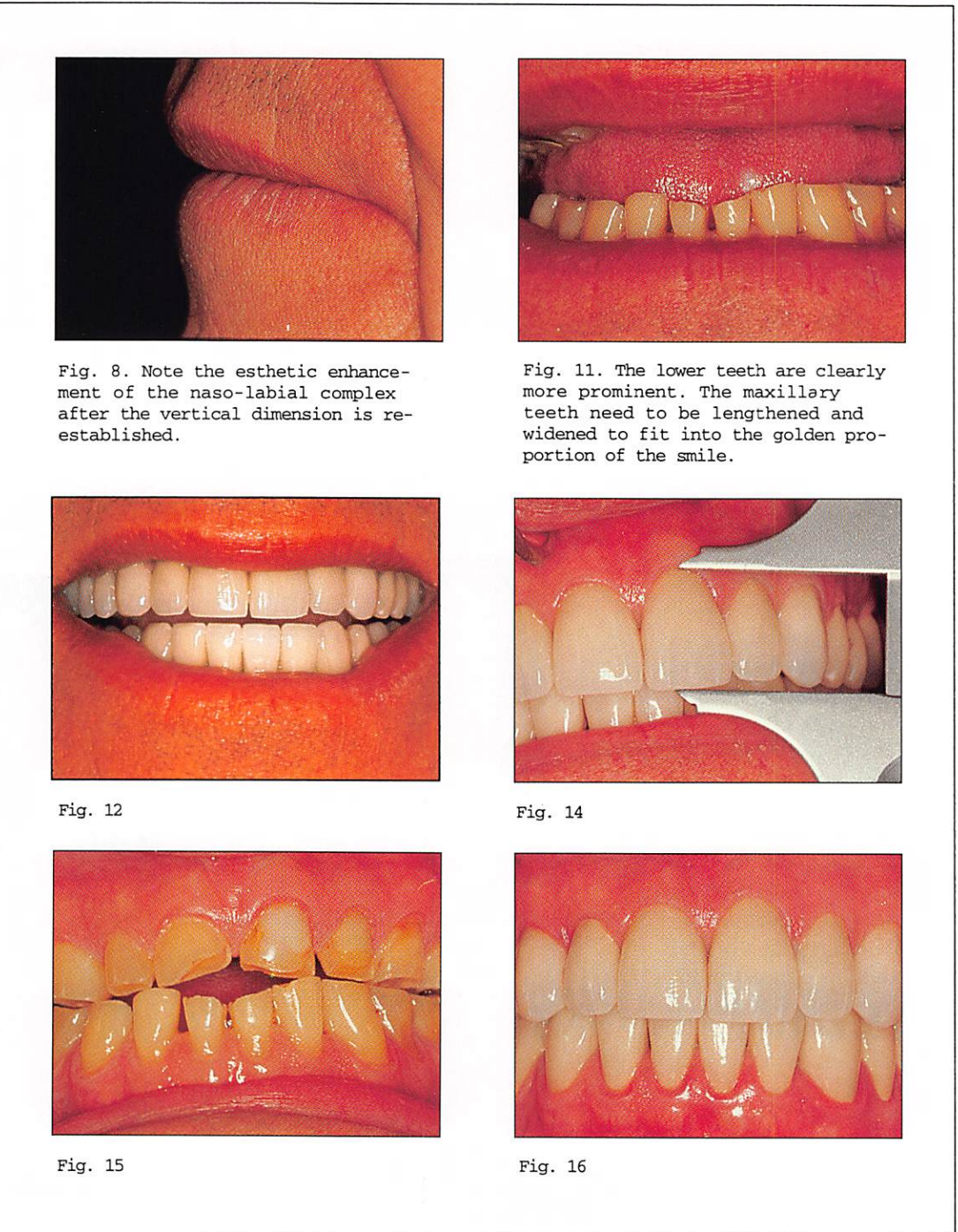


Fig. 8. Note the esthetic enhancement of the naso-labial complex after the vertical dimension is re-established.

Fig. 11. The lower teeth are clearly more prominent. The maxillary teeth need to be lengthened and widened to fit into the golden proportion of the smile.

Fig. 12

Fig. 14

Fig. 15

Fig. 16

Rufenacht says the mouth, by its dimension, mobility, and physiologic and psychologic significance, is the dominant element of the face.⁴ Thus, when we begin rejuvenat-

ing the dental complex, we must start with an examination of the facial complex. The facial complex should be designed from an esthetic objective to create beauty.^{10,11}

Dahl's study, covering a period of five to eight years, concluded that increases in occlusal face height (1.9mm on average) are well tolerated, and do not lead to speedy return

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to basis. In an average case observation time of 5.5 years, no relapses occurred.¹²

The patient is a brachy facial type, characterized by a diminished lower facial height (Fig. 1). In addition, there has not been compensatory eruption of the maxillary apparatus to compensate for the wear on the dentition.¹³ This pathology has resulted in a hypertrophy of the mandibular sling muscles, contracting to their origin and creating a rhomboid appearance of the musculature.⁷

Ricketts believes esthetic evaluation of a patient should involve the entire craniofacial complex. The relationship of the craniomaxillary segment to the lower part of the face is confirmed by using the golden proportion rule.^{8,14} Because of occlusal wear (Fig. 3), the dentofacial composition does not fit the golden proportion profile for facial esthetics. This occlusal wear causes the mesial-distal width of the anterior teeth to become smaller. By increasing the length and width of the anterior/posterior teeth and vertical dimension (Fig. 4), tooth morphology, dentofacial and facial esthetics have been restored.¹⁵

Note the aging musculature of the facial complex (Fig. 1). After treatment, a more youthful appearance resulted because the dentofacial and dental complex are now in golden proportion to the face (Fig. 2).



Figs. 17 and 18. Note the anterior segment separating the posterior teeth in protrusive with the lower cuspid passing through the maxillary lateral. If the canine enamel wears, the first premolar would be the first tooth to assist with lateral guidance. The second premolar would be the second tooth to assist with lateral guidance (posterior guidance).⁵ This diminishment of tooth size creates the graduation effect as we progress posteriorly.

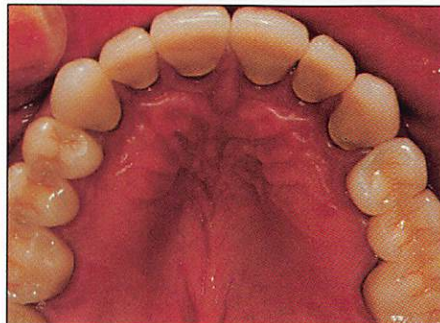


Fig. 20

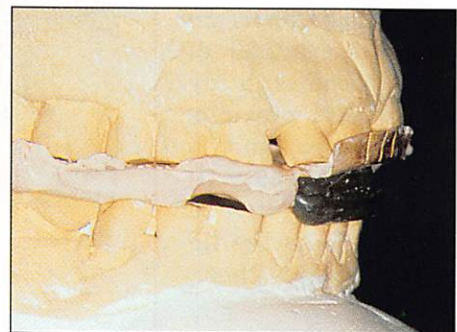


Fig. 21

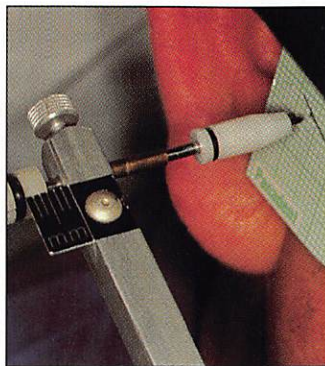


Fig. 22



Fig. 23

By improving function through restoration of the vertical dimension by 5mm, measuring from the gingival marginal ridge of

the maxillary central to the gingival marginal ridge of the mandibular central (Figs. 3 and 4), the mouth's appearance on the

face has been altered to be not only more functionally correct but esthetically pleasing.^{6,10,12,16-19} (Fig. 5 & 6 not shown.) The naso-labi-

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al complex has been altered, which was accomplished by repositioning the occlusal plane and by placing the condyles in centric relations (Fig. 8). (Fig. 7 not shown.) The maxillary teeth were lengthened 5mm (Fig. 14). This, in conjunction with proper vertical dimension and the establishment of the proper occlusal plane, resulted in full beautification of the facial complex.

According to Mach, when the functional and esthetic requirements of the occlusal plane and craniofacial balance are restored, the vertical dimension becomes a dynamic concept, providing dentists the opportunity to improve facial beauty beyond mere restoration of the dentition.⁷ As the figures show, Mach's theory is correct.

Dentofacial Complex

A smile is the primary method used to convey emotions (Fig. 11 & 12) and (9 & 10 not shown). Our goal should be to enhance this feature for our patients. The roll of the vermilion border is inward and appears thin (Fig. 7 not shown). The maxillary central incisors should ideally support the maxillary and mandibular vermilion border. By lengthening the maxillary central incisors from 8mm (Fig. 13 not shown) to 13mm (Fig. 14), a proper roll of the vermilion border and support of the lip has been established (Fig. 8).

Bioesthetics expands

the dental complex into three planes: Frontal, horizontal and vertical, which are now combined in harmony with the facial and dental complexes.

Dental Complex

When we design an overall makeover, we must stay within the boundaries of objective bioesthetic principles. The vertical overbite of central incisors, which averages about 4mm, was developed with 2mm to 3mm horizontal central overlap (Figs. 15 & 16). The canines are in tight 0.5mm to 1mm. The maxillary central incisors,

now lengthened, and the canines are positioned about the same vertically. The lateral incisors, which are 1mm shorter, allow room for the mandibular canines in protrusive movement (Fig. 17). There is a half-tooth size difference between the maxillary and mandibular teeth. The canine axial inclination needs to be towed toward the mesial to allow for this one-half tooth difference, and to position the canines for optimal canine guidance (Fig. 18).

Kawamura's study showed better proprioceptor ability of the anterior

teeth, rather than posterior teeth, with the central incisor having the highest rate. Proprioception was a factor of root surface and sensory receptors in the periodontal ligament.²⁰ When we close on a bolus of food, the anterior teeth are first to guide, with the cuspid being the transition tooth passing the guidance from the anterior to posterior segment. Kawamura's study supports this occlusal scheme or phenomenon. Posterior guidance has been improved through the enhancement of sharp cusps of the posterior teeth to

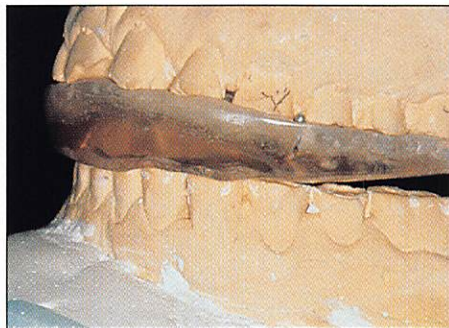


Fig. 24

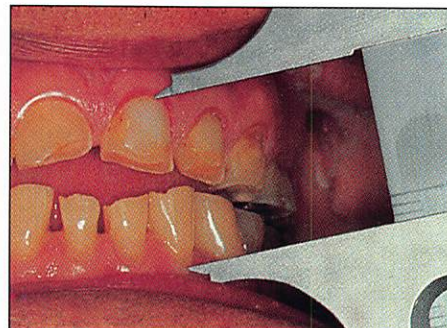


Fig. 25

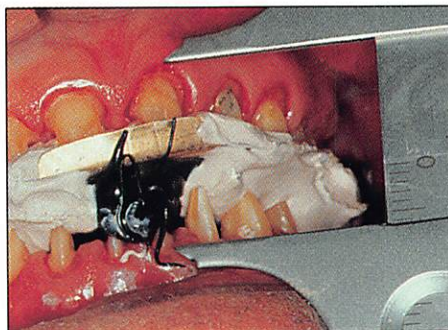


Fig. 26

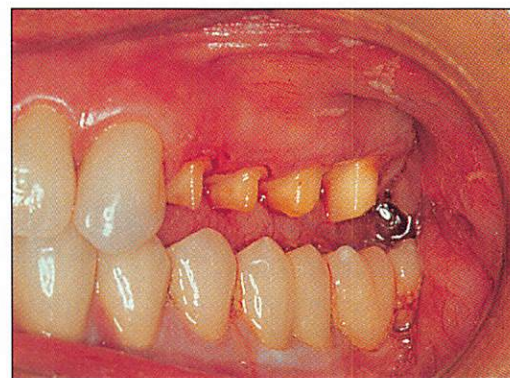


Fig. 27

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verticalize the occlusion (Fig. 20) (Fig. 19 not shown.) This placement provides support for the lips, and protrusive and canine guidance to facilitate separation of at least 2mm of the posterior teeth.^{2,3}

Treatment

Radiographic, Tomogram, Cephalometric, Panorax, and a full-mouth series of X-rays of this patient revealed no significant pathology.

A photographic series consisting of 35mm slides, color prints and Polaroid pictures was taken before the start of treatment.

Diagnostic records consisting of centric bite record, axi-path recordings using the Panodent system, and an orthodontic photographic series were also taken (Figs. 21 & 22). (Note the green stick used as an anterior jig. This deprograms the musculature before recording lower on centric record wafer.)

After much review of 1:10 front view and profile view of 35mm slides, the vertical dimension was determined. A wax-up of the ideal occlusion on the centric recording study models in centric relationship occlusion was built (Fig. 23). The wax-up was used to determine the appropriate position of the occlusal plane and vertical dimension.

Phonetics are *not* used to establish vertical dimension or freeway space. Rugh, Wyke and Helsing

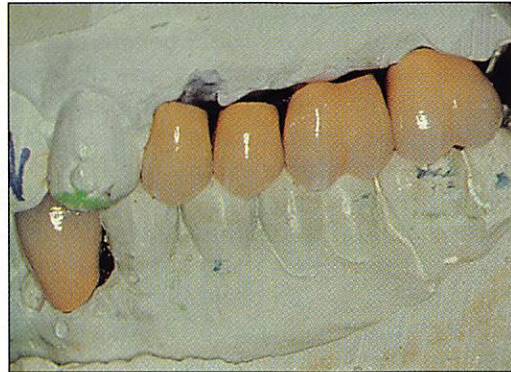


Fig. 28

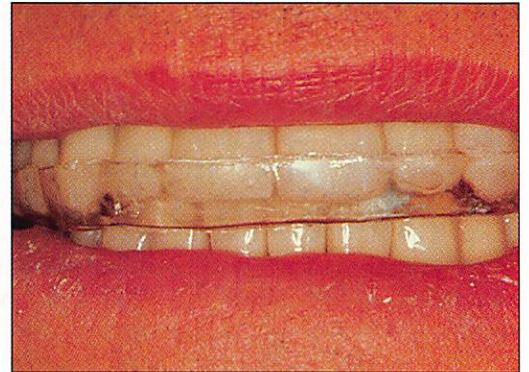


Fig. 29

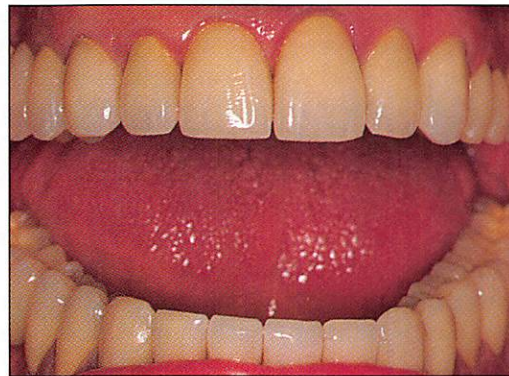


Fig. 30

discuss that the clinical rest position changes with the vertical dimension of occlusion in an initial adaptation.^{16, 19, 21} The interocclusal distance varies because it is controlled by tonic muscle activity, which is influenced by the vertical dimension of occlusion. Airway, posture, tension and phonetics can influence this position, but all clinical normal functional movements of the mandible originate from clinical rest, not from phonetics.

A Panodent articulator was used with settings of 2.5mm analogs and a condylar angle of nine on the right side, and 10 on the left side. These settings were derived from the axi-path recorder of condylar inclination and Bennett movement. The hinge axis was also marked at this time. The posterior teeth would have 60-degree cusp inclination.²² Cuspid rise, anterior guidance and verticalized occlusion were built into the wax-up (Fig. 23).

A maxillary anterior guided orthotic splint, or MAGO splint (Fig. 24), was constructed to centric relationship, re-establishing vertical to 20mm (Fig. 25), originating at the maxillary central gingival margin and extending to the mandibular central gingival marginal crest.¹⁶

The MAGO splint was placed, as described above, and was worn by the patient for two weeks at the new 20mm vertical dimension opening. No discomfort was reported. A-

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rylic posterior stops were placed two weeks later, and the patient wore the splint 24 hours a day without difficulty.

An impression was taken of the wax-up to fabricate the provisionals at the new vertical dimension. The anterior teeth were prepared first with shoulders at the gingival crest and no bevels.

The acrylic temporary shells were filled with Jet acrylic, and placed over the maxillary and mandibular crown preparations. The patient was then asked to bite down. The Dawson technique was used, having the patient tap his teeth together.²³ A Boley gauge was used to measure the vertical at a 20mm distance from the maxillary central gingival margin to mandibular central gingival margin (Fig. 26). After the anterior teeth have been provisionalized and the occlusion redefined, it is extremely important that the posterior teeth have at least 2mm to 3mm between them. If not, the patient's anteriors will flare while trying to occlude the posterior teeth. The occlusion, protrusive and cuspid guidance, were also closely checked.

The patient was then checked two weeks later and the occlusion redefined. If the patient is not experiencing any muscle symptoms, work on the maxillary right and left posterior segment is begun.

Maxillary teeth Nos. 2 through 5 and 12 through 15 were prepared with the shoulders at the gingival crest. Provisionals were completed following the same procedures described above. The provisionals were constructed so they occluded with the mandibular teeth. Doing this creates a reverse Curve of Spee, but allows the patient to masticate. The mandibular teeth Nos. 18 through 21 and 28 through 31 were prepared and provisionalized as described above.

The occlusal surfaces of the maxillary provisionals are ground down, Jet acrylic added, and placed in the mouth. Vaseline is added to the mandibular provisionals, and the patient is closed in centric relation occlusion. This procedure corrects the Curve of Spee. When checking the occlusion, the provisionals or crowns, teeth Nos. 22 and 27, are always removed first to eliminate avoidance patterns when equilibrating posteriors.

The patient remained in provisionals for about three months to ensure that the occlusion was stable.

Final Preparation

The maxillary and mandibular provisionals were removed, and the crown preparations on teeth Nos. 6 through 11 and 22 through 27 were redefined and bevels placed. The provisionals

were removed from the posterior teeth. An Ear Bow was taken so the maxillary could be mounted on a Panadent articulator. A closed centric bite was taken to mount the maxillary to the mandible. A Boley gauge measured the 20mm distance selected as the vertical dimension of occlusion with the centric bite in position (Figs. 25 & 26).

The provisionals were relined with Jet acrylic to add the bevel portion, and cemented in place with Fynal cement. The occlusion was checked again to make certain the teeth were still in centric relationship occlusion.

Laboratory

Photographic prints and 35mm slides are taken for each case, even though all full-mouth rejuvenation cases are seen by the technician. Vita shade A-2 was used for the centrals, and A-3 was used for the cuspids. The crowns were fabricated on the Panadent articulator at centric relationship occlusion, and the 20mm vertical, condylar angle and Bennett settings.

Using bioesthetics, the suggested measurements for this patient should be 12mm for the maxillary central incisors, 12mm for the cuspids, 10mm for the mandibular central and lateral incisors, and 12mm for the mandibular cuspids. The length of the maxillary laterals is determined in conjunction with

the mandibular cuspids to guide through in protrusive movement (Fig. 18). The width is predicated as stated above using the golden rule, negative space (dark area between teeth and cheek), and the size of the mouth. The gingival margin crest of the maxillary central and cuspid must be horizontally even, and the lateral about 1mm shorter. The posterior occlusion must rise toward the Frankfort Plane with the maxillary cusp tips and the gingival margin crest converging as we move posteriorly. The embrasure between the maxillary centrals is about 1mm, the lateral to the central 2mm, and the lateral to the cuspid 3mm. The incisal edges of the maxillary teeth must be parallel to the horizon, and must conform to the lower lip line in a natural smile.³

Applying the criteria described above, which included a review of the slides and an evaluation of the temporaries, I was able to recommend treatment to reach the bioesthetical goals of natural form and function.

The procedures outlined above are the general guidelines I use, which are then altered to focus on the bottom third of the facial configuration, the lip size and the smile line.

The patient returned in two weeks for a bisque try-in. The occlusion was adjusted using the Dawson technique, paying close

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attention to esthetics. Slides were taken for laboratory use. In those instances where the occlusion has a large margin of error, an open bite centric is taken at this stage, and another bisque try-in is performed.

The crowns were tried-in again two weeks later. The occlusion was adjusted, and the crowns were cemented temporarily with Surgident multi-form paste.

An open bite centric was done several weeks later using the hinge axis previously marked on the patient.

The crowns were returned one week later. The maxillary crowns were temporarily cemented with Surgident multi-form paste. The mandibular crowns for teeth Nos. 23 through 26 were cemented in permanently with Flecks cement. The occlusion was checked again, followed by cementing in the two mandibular cuspid crowns with Surgident multi-form paste. The posterior temporaries were recemented with Fynal cement.

Summarizing the order of the complete rejuvenation, the anterior section is completed first, the mandibular posterior second, and the maxillary posterior last (Figs. 27 and 28). As shown, the mandibular cuspids are always removed to check posterior occlusion.

Preparations on teeth Nos. 18 through 21 and 28

through 31 were finalized by placing a bevel on the shoulder. The retraction, final preparation and provisionalization were then completed. The provisionals were removed from the maxillary posterior teeth. An Ear Bow was taken so the maxillary could be mounted on a Panodont articulator. A closed centric bite was taken to mount the maxillary to the mandible using Regisil. A polygel impression was taken. The records and impression were sent to the laboratory.

Porcelain crowns were constructed for teeth Nos. 18 through 21 and 28 through 31. Particular attention was paid to tooth morphology with 60-degree cusp inclination, as found in healthy young dentition.²²

Cementation

The mandibular crowns were returned three weeks later. The provisionals were removed on both the maxillary and mandibular teeth. All crowns were checked for proper fit by using Fit Checker.

An alginate impression of the maxillary and mandibular teeth and a Regisil bite were then taken. The laboratory mounted these two models on an articulator to determine if the maxillary preparations provided adequate room for the proper occlusion (Fig. 27 and 28). The occlusal maxillary provisional crowns were ground down, and acrylic

was added and placed in the mouth to re-establish a proper centric relation occlusion. The occlusion was defined on the right side first, followed by the left side. The provisionals were then cemented with Fynal cement by Caulk. The occlusion was checked again. The mandibular crowns were cemented temporarily with Surgident multi-form paste.

The same procedure for crown fabrication was completed on the maxillary posterior teeth, just as they had been done on the mandibular teeth.

The patient returned two weeks later. The maxillary crowns for teeth Nos. 2 through 5 and 12 through 15 were received for a bisque bake try-in. The crowns were tried in and adjusted as described above for the mandibular crowns. The occlusion was adjusted using the Dawson technique. A cusp-marginal ridge occlusion was established. If there had been a major discrepancy, an open bite centric would have been initiated at this time. The crowns were returned to the laboratory for the final bake.

The crowns were returned and placed in the patient's mouth temporarily with Surgident multi-form paste. The occlusion was adjusted as described before.

Final Cementation

An open bite centric was done several weeks later using the hinge axis,

which was previously marked on the patient. A centric bite tray from Panadent was used to register the bite. The maxillary anterior crowns were cemented in at this time. The maxillary posterior crowns were sent to the laboratory in the polygel impression. A new alginate impression was taken of the mandibular teeth, since there could have been some change in teeth during the last few weeks.

The patient returned one week later, and the maxillary posterior crowns were placed in the mouth. Minor occlusal adjustments were made, and the crowns were cemented temporarily. The mandibular posterior crowns and bridges were cemented permanently.

Centric occlusion was checked periodically. The crowns, except for teeth Nos. 22 and 27, were cemented permanently. The crowns for teeth Nos. 22 and 27 were cemented one year later. A night guard was fabricated as a precautionary measure (Fig. 29).

Function and objective esthetics are interrelated. This case was completed in 1992. A photo taken in 1995 shows that the treatment provided is as solid now as it was at the time of completion (Fig. 30). By incorporating both esthetic and functional principles, this patient will benefit for years to come. ♦

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