Often, we see patients in our clinical practices in need of cosmetic and functional reconstruction. These reconstructions frequently involve the anterior teeth. Worn edges, cosmetic demands, deep bites and concerns for ongoing parafunction are all components of a reconstruction that concern dentists.

The Chasolen Triad of Reconstruction describes:
- Aesthetic A and B point
- Vertical occlusal dimension
- Excursive pathway considerations applied to reconstructions

The goal of modern restorative dentistry is to restore any patient, on the continuum of dental presentations, to normal form, function, contour, comfort and aesthetics. Understanding the anterior and posterior determinants of aesthetics and occlusion allows us to develop a predictable and repeatable protocol for analyzing and treating any cosmetic or occlusal presentation. (Fig. 1) Many have discussed the incisal edge position of anterior teeth and their influence in dictating overall tooth position, placement and outcome. Dr. Earl Pound published “Personalized Denture Procedures” in 1973 and discussed the aesthetic and phonetic interrelationships of the anterior teeth as the guide to a successful denture outcome.

The anterior determinants of tooth position are governed by labial contour, incisal edge position and lingual contour. By beginning with a systematic approach to tooth position, establishing the labial and incisal determinants of the maxillary and mandibular teeth are an outcome of lip support, aesthetic profile, lip closure path, tooth display, curvature of the lower lip and phonetics. The lingual anterior determinants become a customization of the occlusal considerations. The labial and incisal positions are largely determined by aesthetic parameters and the lingual by occlusal considerations such as vertical dimension of occlusion, arch relationship, parafunctional patterns and intended excursive pathway angles. The aesthetic plan is the architecture and the occlusal plan is the engineering.

If the aesthetic plan is at risk due to engineering concerns, the aesthetic plan requires modification. For example, we all have patients with extensive wear. Some present with a horizontal pattern and some a vertical pattern (Figs. 2 & 3). If the clinical presentation is one with a deep bite with vertical or angular vectors of wear (Fig. 4), a particular etiology and diagnosis may be determined. If one presents with a more end to end wear and a more horizontal vector of wear, another etiology and diagnosis may be determined.

Let’s take figures 2 and 3 for example. This patient has a worn dentition secondary to chemical erosion and horizontal, protrusive parafunction. The patient desires additional tooth display at rest and during smiling. This requires adding length to the maxillary anterior teeth. If the teeth are lengthened at the current VOD, there will be no room for the new length and restorative material, and they will surely fracture. Therefore, increasing his present VOD may be necessary. This allows control of not only the space required for the restoration but the steepness of the anterior pathways to manage parafunctional damage.
Steps in configuring the anterior relationship for reconstruction

1. Establish preliminary aesthetic A Point. (The 3-dimensional point in space where the mesio-incisal-facial point of #8 and #9 is aesthetically correct in a mesio-distal, bucco-lingual and incisogingival position (Fig. 5)
2. Establish preliminary aesthetic B Point. (The three dimensional point in space where the mesio-incisal-facial point of #24 and #25 is aesthetically correct in a mesio-distal, bucco-lingual and incisogingival position.) (Fig. 6)
3. Establish a preliminary condylar position.
4. Establish the preliminary vertical occlusal dimension.
5. Create lingual cingulum contours based on function and parafunction.

This case presentation and discussion will address the interrelationships between the aesthetic and occlusal determinants and present a rationale for their management.

The patient is a 62-year-old male with the chief complaints that he does not like the way his lower teeth look, he’s having trouble chewing, and his wife is unhappy with how they look.

The patient had recently moved to town. He has been seeing his family dentist for 25 years. He has inquired about the ongoing progressive wear of his lower teeth, but was told “if it doesn’t hurt, I wouldn’t open up a can of worms.”

Aesthetic evaluation

Many have discussed lengthy and sophisticated analyses to establish an aesthetic diagnosis and treatment plan. I have attempted to simplify the aesthetic analysis by using visual confirmation of the correct position of the maxillary and mandibular anterior teeth. Photography is critical in diagnosing and planning reconstructions. In particular, the lip at rest position is my most valued
image. We know from the work of Dr. Galip Gürel and others that incisal edge display at rest varies by age and arch.

As we age, we show less maxillary incisal edge and more mandibular incisal edge. This is due to tooth wear, eruptive patterns and facial soft tissue dynamic changes. However, it is readily accepted that a pleasing maxillary display at rest should be 1mm at minimum. The mandibular display at rest is more variable and allows the dentist to manipulate this position to accommodate the VOD stipulations. Often, wear of the mandibular incisors presents challenges from the B Point perspective. The problem associated with wear is that once it progresses to a certain point, the restoration of the tooth can be impossible. If the lower incisal edge appears to be worn 3mm from the original edge, but the B point is at its maximum height, then either two additional millimeters of reduction is required for ceramics, orthodontic intrusion to apically place the incisal edge or increasing the vertical occlusal dimension by 2mm at the incisor in order to allow adequate thickness of restorative material. Once A and B point have been established, the VOD now required stipulation.
In the case of this patient, his aesthetic A point is fairly reasonable (Fig. 7). The incisal edge display is approximately 1mm at rest. Although the incisal plane is inconsistent, as #11 hangs below the esthetic plane, once point A is established, the remaining anterior teeth are specified ideally to the lab for the wax up. The B point is a more difficult determination. However, it is less aesthetically demanding and therefore has room for variation. In this case, B point is approximately the mesial incisal corner of #23. (Fig. 7). If we draw a line across the incisal plane and extend that line back to the posterior quadrants, we can see the amount of length increase and the resulting amount of occlusal addition required to accommodate the newly proposed B point (Figure 8 & 9). Figure 8 shows the blue print of A point determination. Figure 9 is detailing different proposed B point incisal edge positions and their effect on the occlusal plane. In this case, we have selected #23 mesial incisal corner as the correct B point. It does require an increase in VOD, however, the increase is within the proposed acceptable guidelines of 3mm. These specifications are detailed to the lab for the initial wax up.

Now that we have established the correct maxillary A point and mandibular B Point, they must be matched in the occlusal environment. This involves the condylar position and the vertical dimension.

**Overall occlusal evaluation**

Significant wear was noted on the maxillary and mandibular sections. The patient has a deep vertical overbite. There is significant wear patterning on the anterior teeth. The lower anterior teeth have significant vertico-angular wear. The incisal edge is at its most superior position on the trailing or lingual edge of the tooth. The maxillary anterior teeth have lingual wear. The cingulums are hollowed out and worn through the enamel. In today's speak we would consider a diagnosis of anterior constriction of the envelope of function. Interestingly, the posterior teeth have very little occlusal wear. Visually, his vertical occlusal dimension appears a bit overclosed.

**Condylar position**

My simplification of condylar position is either seated with a released lateral pterygoid or somewhere other than that position. Centric relation is completely independent of tooth contact. It is a neuromuscular or orthopedic position that occurs when the mandibular condyles articulate with the thinnest avascular portion of their respective disks in an anterior/superior position against the shapes of the articular eminences. This position is one of restorative opportunity and convenience.
An in-depth discussion on condylar position is not practical for a case report such as this, however, suffice it to say, from my perspective, 99 percent of all of my reconstructions are built with a perceived seated condylar position. This position is freely achieved by the patient, without directed manipulation and always free of pain. Making initial occlusal records for preliminary waxing can be achieved with the use of an anterior deprogrammer (Lucia jig, Pankey deprogrammer, leaf gauge or any anterior midpoint stop jig. This device should be fashioned at a minimally opened vertical dimension. Enough to verify no posterior tooth contact after 20 minutes on the jig with light squeezing into the anterior stop).

The preliminary condylar position record is always taken with the teeth separated at a minimally open VOD to ensure no undue directive proprioceptive influence from the teeth themselves.

It is advisable that a facebow record is made when condylar position is recorded at an open vertical dimension. The facebow allows a reasonable accuracy of articulator closure to close the vertical dimension from the recorded open position to the initial tooth contact. In a nutshell, condylar position is totally independent of teeth. The teeth are along for the ride. And we want to ensure when the condylar position is selected for reconstruction, the teeth or finished ceramics are not harmfully in the way of the seated condylar closing pattern. Of course all of this only matters when the teeth are actually occluding and therefore the time and place or the when of occlusion may be the most important question of all.

**Vertical dimension**

The occlusal vertical dimension defines the distance between the occluding maxillary and mandibular teeth. This is largely determined by the remaining teeth. However, missing teeth, worn and compensatory eruption all influence the state of the vertical dimension. Some authors have suggested that occlusal vertical dimension remains constant throughout life and increasing the presenting VOD via reconstruction comes with deleterious consequences. Drs. Mark W. Schuyler and R. W. Tench discussed the concern for the risk of the supporting structures including muscles, joints, teeth, periodontium and today we are concerned with ceramics. Much of this fear was anecdotal and without scientific merit. Some have discussed the consequences of a decreased VOD to include disk perforation, tinnitus, loss of masticatory muscle tone and issues with swallowing.

Rest space, aesthetics, joint status, remaining tooth structure, and loss of posterior occlusal support have all been proposed as criteria to evaluate in determining the occlusal vertical dimension status. However, many studies have proven the traditional concerns to be without merit. General guidelines for the safe increase of the vertical dimension from its presenting position range from 2.5mm-5mm interincisally without deleterious effect.

Important questions to be answered about a proposed increase in the VOD would include those involving relapse potential, resulting muscle tone, adaptation of the rest position, impact on TMD, effect on periodontium and bone loss.

Because the literature is inconclusive in its evaluation of the proposed dangers of increasing the vertical dimension of occlusion for reconstruction, the careful increase of the VOD may be considered for restorative purposes. My experience after reconstructing over 850 full arches, is that increases in the presenting VOD up to 3mm at the level of the incisors poses little to no danger with regards to the muscles, joints and periodontium and actually provides benefits in the management of restorative materials in the form of idealized tooth contacts, functional and parafunctional freedom of movement and control of parafunctional excursive pathway angles to minimize potential material destruction and secondary occlusal trauma.

**Periodontal evaluation**

No tooth with the exception of #26 and #27 probed greater than 3mm. Tooth #27 is labial verted and requires extraction for both periodontal health and space management. Minimal recession was noted. Adequate attached gingiva was present and no furcation involvements were noted. Minor gingival inflammation was noted and considered to be plaque induced gingival inflammation.
Restorative evaluation

Numbers 2, 3, 4, 5, 7, 12, 13, 14 and 15 are already restored with full coverage crowns. Because we are proposing an increase in the presenting vertical dimension, these crowns will be replaced. Numbers 18, 19, 20, 21, 28, 29 and 30 have full coverage crowns and will require replacement as well. Meanwhile, #31 has a large amalgam filling that will be replaced with a full coverage restoration as well.

Diagnosis

1. Occlusal wear secondary to anterior constriction and parafunction.
2. #27 periodontally hopeless.
3. Defective crown margins 2, 4, 5, 7, 12, 14, 18, 20, 28, 29.
4. #31 had caries at existing amalgam restoration.
5. Aesthetic concerns. Specifically displeasure with the lower anterior teeth.
6. Retroclined and constricted maxillary teeth.

Treatment plan

Full mouth reconstruction with full coverage restorations 2-15, 18-31

Phase 1: Diagnostic

1. Articulated study casts. The patient will be deprogrammed utilizing an anterior jig and the jaw relationship will be recorded at the most minimally open vertical dimension. A facebow record will be made to allow a reasonable accuracy of the hinge axis to allow the vertical dimension to be manipulated on the articulator once the diagnostic casts are articulated. However, the final restorative bite will be made at the correct vertical dimension.
2. Wax up to stipulated parameters. The information gathered from the aesthetic work up will be utilized to wax the case to full contour. It is important to note that this wax up is a preliminary blue print. It will need to be modified in the provisional stage in the mouth as incisal edge position, lip closure path, phonetics and guidance patterns are customized. (Figs. 10-12)

Figure 10 shows the pre-operative study casts and the A and B point waxed ideally based on our initial work up. However, it does not consider the two arches together.
Dr. Howard Chasolen graduated from the University of Medicine and Dentistry of New Jersey in 1991. He earned a specialty certificate in prosthodontics and a fellowship certificate in Implant Prosthodontics from the University of Pittsburgh School of Dental Medicine from 1991 to 1994. He is a diplomate of the American Board of Oral Implantology and a Fellow of the American Academy of Implant Dentistry. His private practice is located in Sarasota, Florida, and is limited to prosthodontics, cosmetics, implant dentistry and the restoration of the complex interdisciplinary patient. He has restored over 18,000 units of crown and bridge and over 9,000 implants.