

## An evaluation of 50 years of reconstructive dentistry. Part I: Jaw relations and occlusion

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The past 50 years have witnessed the introduction of many concepts intended to improve the quality of dental care. Most innovations have been directed toward occlusion and have been promulgated to maintain and/or improve periodontal health. The practice of reconstructive dentistry and the introduction of occlusal theories have coincided for half a century. Reconstructive dentists have enjoyed the rare opportunity to evaluate the proposed preventive and therapeutic values of the theories.

This article represents a critical evaluation of the theories of occlusion by a reconstructive dentist based on 50 years of experiences.

### OCCLUSION DEFINED

No subject has received more attention or created more controversy than the functional and nonfunctional movements of the mandible. Occlusion may be defined as "contact of the maxillary and mandibular teeth in closure, a static position." Articulation refers to "the mandible in motion, a kinematic relation." Both occlusion and articulation are essential to interocclusal relations. Mastication clarifies the definitions. While chewing is in effect, the laws of motion prevail. This is articulation. After the bolus has been adequately comminuted, it is swallowed, and the maxillary and mandibular teeth meet in full contact. This is occlusion.

### ESSENTIAL CONSIDERATIONS

#### Centric relation

A correct centric relation is a major requirement for successful prosthodontics. This exists when the maxillary and mandibular teeth are in maximal contact. Teeth occlude frequently, not only in mastication, but throughout the day during the act of swallowing. For the edentulous patient, teeth may be arranged to provide maximal contact in centric relation. For dentulous patients, this may be more

difficult. The remaining natural teeth may be in incorrect positions. The ability to create a harmonious interocclusal relation may tax the ingenuity of the most experienced and careful dentist.

An experienced dentist may know when the mandible is correctly related to the maxillae. This is a three-dimensional relation which involves lateral, anteroposterior, and vertical placement. Many methods have been described to attain a correct centric relation.

#### Interocclusal distance

There is a space between the maxillary and mandibular teeth when the mandible is in its physiologic rest position. This is the interocclusal distance, a basic requirement for successful prosthodontics. An overextended interocclusal distance prevents muscular relaxation; an overshortened interocclusal distance causes an overrelaxed musculature. In either instance, the neuromuscular tonus is disturbed. An incorrect interocclusal distance reflects itself in the muscles of expression and, therefore, in esthetics.

#### Function

In addition to comminution and deglutition, function of the stomatognathic system includes speech, breathing, coughing, and sneezing. People should be unaware of the oral cavity unless health factors intervene. The sense of "oral comfort" includes physical and psychologic sensations.

#### Systemic factor

Accumulated observations and records refute the concept that correct interocclusal relations alone portend good dental health. Apparently the nebulous systemic factor influences results. Given a good systemic factor, the interocclusal relations assume secondary importance. On the other hand, patients with excellent occlusal relations but a subnormal

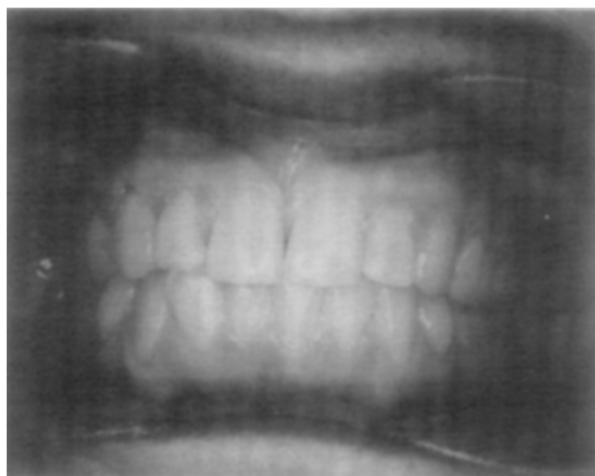


Fig. 1. Centric occlusion of a 55-year-old patient with full complement of teeth.

systemic factor experience deterioration regardless of therapy. We have not yet discovered what constitutes a good systemic factor, but we do know that it is not the local environment.

### Psychologic influences

Failure may be attributed to psychologic factors when therapy cannot be completed or when the treatment has been unsuccessful without a reasonable explanation. Although dentists cannot be expected to serve as psychiatrists, the limit of their obligation to such patients should be clearly defined. Permitting patients to fully express themselves before treatment often exposes emotional problems. The dentist may decline to treat the patient, establish the possibility of withdrawal if an emotional obstacle precluded proper treatment, or refer the patient for psychiatric therapy in conjunction with dental treatment.

### Articulators

All articulators are subject to error in manipulation and transfer of records. The accuracy of creating an articulation depends upon a concept of occlusion. Years of experience dictate caution in accepting a specific theory. Good results have been attained using diverse techniques and articulators.

By far, most patients are successfully treated by well-established methods of conformational dentistry created on simple articulators. The semiadjustable articulators, such as the Hanau H or similar instruments, embody conventional ideas. They are simple to operate, compact, and durable. They may be

adjusted with wax records, and they may be successfully used for fixed and removable partial dentures.

A semiadjustable articulator should accommodate the Bennett movement even though it may be compromised by using an arbitrary formula or similar device. The face-bow is an important adjunct to the semiadjustable articulator.

### Temporomandibular joint

The temporomandibular joint (TMJ) exercises control over rotational jaw movements when the working condyle is braced superiorly and anteriorly against the glenoid fossa. Only then are the independent TMJ axes in control of the arc of closure. The terminal functional movements of closure are constant and repeatable. All others are erratic and, therefore, cannot be mechanically reproduced. Eccentric jaw movements are nonfunctional and have little value.

Cinefluorographic studies of the masticatory movements of the mandible demonstrated that the condyle paths are erratic as controls in articulation.<sup>1</sup> Burgess<sup>2</sup> regarded condylar guidance as a myth.

## SECONDARY CONSIDERATIONS

### Occlusion and periodontal pathosis

Faulty occlusion is presumed to be largely responsible for periodontal disease. Correcting occlusal discrepancies has become the "major aim of dentistry."<sup>3</sup> Clinical observation denies this concept. The etiology of periodontal disease is unknown. It is often related to the "systemic factor." Only in selected patients has periodontal disease been eliminated by correcting interocclusal variants. Despite this observation, the concept that most periodontal problems are created by occlusion persists.

The effect of occlusal trauma has been well defined by Glickman<sup>4</sup> who stated that the problem is not occlusion but whether occlusion causes injury to the periodontium. Trauma may occur when the occlusion appears to be "normal." A dentition may be anatomically and esthetically correct and still be functionally injurious. Malocclusions are not necessarily injurious. If the periodontium can accommodate an increased occlusal force, it is not traumatic.

The accusation that functional chewing is responsible for injury cannot be supported by the experience of years of practice. Bruxism, defined as "grinding, clenching, and gritting the teeth" during much

of the day and night seems to be the chief offender where deterioration of the supporting tissues is suspected of being caused by traumatic interocclusal relations.

The dental literature is replete with occlusal concepts and theories designed to improve and maintain periodontal health. None of these enjoys universal acceptance as each has defects. The following comments resulted from dissents in the literature and from personal experiences.

### Pantographic tracings

These are pin-on-plate records of jaw movements. The pins of the pantograph provide the direction of mandibular movements.<sup>3</sup> The applied force over a simple bearing point, a fulcrum, precludes normal mandibular movements. To overcome lateral interferences, the increase in vertical dimension may bring the condyles anterior to their rest position and/or centric relation.

### Axis orbital or cranial plane

Three points of reference are required to orient an object in space. That requirement is served by the hinge axes and any anterior point. Two theories of occlusion refer to the axis orbital or cranial plane.<sup>6</sup> Other theories fail to mention them. The Hanau H, Kinescope, and Condylator make no provision for the plane. However, the notch on the incisal pin serves as the third point if the incisal edges of the maxillary anterior teeth are on a level with the notch.

### Bennett movement

There are several descriptions of the Bennett movement.<sup>7-9</sup> Every possible movement from lateral to upward, downward, backward, or forward has been attributed to the Bennett movement. Sicher<sup>10</sup> proposed that its cause results from the time lag between contraction of the nonworking pterygoid muscle and the working temporal muscle. Schuyler\* considered the Bennett movement unimportant because of the small distance between the TMJ and the occlusal surfaces of the teeth. Obviously there is disagreement on the Bennett movement and its effect on occlusion.

### Nontraumatic relations

Patients with a traumatic interocclusal relation require adjustment of occlusion and jaw position to

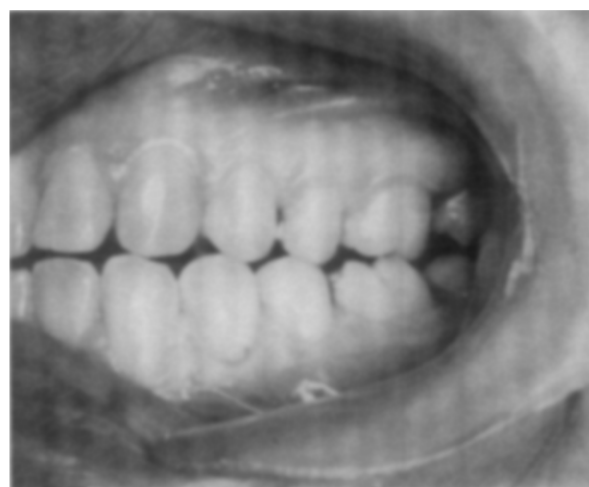


Fig. 2. Left working occlusion. There is no canine lift.



Fig. 3. Right working occlusion. There is no canine lift.

produce a nontraumatic relation. Among the concepts advanced to produce the desired relation are the following:

1. Segmental occlusions—functional contact of groups of teeth at one time
2. Bilateral balances—simultaneous contact of all teeth in function
3. Terminal functional orbit—contact of all teeth only when they engage in the final 1 or 2 mm of closure
4. Group functions—contact of the teeth from the canine posteriorly only on the working side with the balancing side out of contact in lateral excursion
5. Canine protections—maxillary canines acting to prevent attrition of the posterior teeth and in

\*Schuyler, C. H.: Personal communication, March 9, 1977.



Fig. 4. Left view of dentition at start of reconstruction.

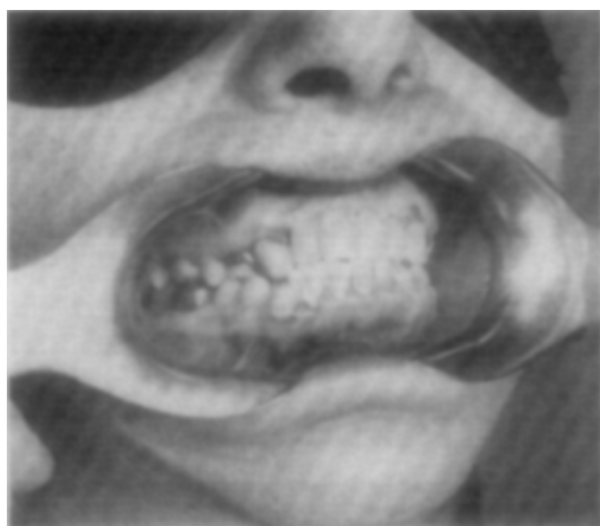


Fig. 5. Right view of dentition at start of reconstruction.

lateral movement, canines causing the posterior teeth to separate

6. Action of canines in forming posterior interocclusal relations, with canines guiding, and directing formation of cusp carvings of the posterior teeth, and canines and posterior teeth having simultaneous contact in lateral excursions on the working side.

### Canines

Several theories relate to canine lift, or canine guidance, which causes disclusion of the posterior

teeth in lateral or bruxing excursions. In protrusion, the articular eminences and vertical overlap of the incisors determine the disclusion of the posterior teeth. These concepts were apparently based on the work of D'Amico.<sup>11</sup> However, in a frame-by-frame motion picture analysis made on 100 young people, 81% demonstrated working side contact (group function).<sup>12</sup> Most of my patients over 54 years of age, who presented with normal occlusion and good periodontal health, also presented occlusal contact in lateral excursion. Fig. 1 shows the dentition of a 55-year-old patient. She was first seen 22 years earlier. Her periodontal health was good, and radiographic examination showed no bone loss. Her oral health remained static, and at 55 years of age the radiographs confirmed that the periodontium remained unchanged. Figs. 2 and 3 show the right and left lateral excursions. There was no canine lift. This was the rule rather than the exception for patients this age and older. Apparently, canine protection of posterior teeth occurs in young people. As a result of the canine protection concept, there is a trend toward stressing the vertical aspect of chewing. Nevertheless, contrary theories reject the concept of canine protected occlusion.<sup>13, 14</sup>

Recent investigation showed that most perforations are on the lateral aspect of the articular disk.<sup>15</sup> This indicates that the TMJ is a stress-bearing joint. Posterior cusps on the working side in group function may provide protection for the TMJ during mastication.

The Pankey-Mann-Schuyler theory\* differs on the function of the canines. This concept indicates that the role of the canines is to guide the posterior teeth in lateral function and to provide contact of the canines and posterior teeth. When possible, all anterior and posterior teeth on the functioning side are in simultaneous, even contact without contact on the nonfunctioning side.

### Gnathologic concept

Comparing the gnathologic and neuromuscular concepts of occlusion, Silverman<sup>16</sup> concluded that mandibular manipulation may alter normal occlusion to create a pathologic condition, since it temporarily places the mandible in its most retruded position out of centric relation. He added that tap-tapping is the most effective method to pinpoint

\*Schuyler, C. H.: Personal communication, March 9, 1977.



Fig. 6. Cutting edge of razor blades resting in central grooves of casts of mandibular teeth.

horizontal relations between maxillary and mandibular teeth. Standard and Lepley<sup>17</sup> also stated that the first movement from rest position to occlusal contact is upward and vertical.

Not all advocates of current theories support the concept of cusped teeth. Some propose that with time cusps become unnecessary. This differs from the concept that interdigitation of cusps maintains stability of occlusion. Contrary opinions suggest that the function of the cusps is to guide the teeth into their occlusal relations.<sup>18, 19</sup> Wear of the cusps produces the curves of Wilson and Monson and also eliminates premature contacts.

In 1942, I reconstructed the dentition of a patient using the blade method advocated by Schuyler.<sup>20</sup> This technique uses razor blades to create the working and balancing occlusions. Figs. 4 and 5 illustrate the oral health of the patient upon presentation. The radiographs confirmed existing periodontal pathosis. The original casts were mounted on a Hanau articulator. Fig. 6 shows the mandibular cast in place and two razor blades, shaped to conform to the anteroposterior curvature, set in the central grooves of the cast of the posterior mandibular teeth. The razor blades were secured with dental stone so that moving the maxillary arm of the articulator scraped the mandibular cast to establish

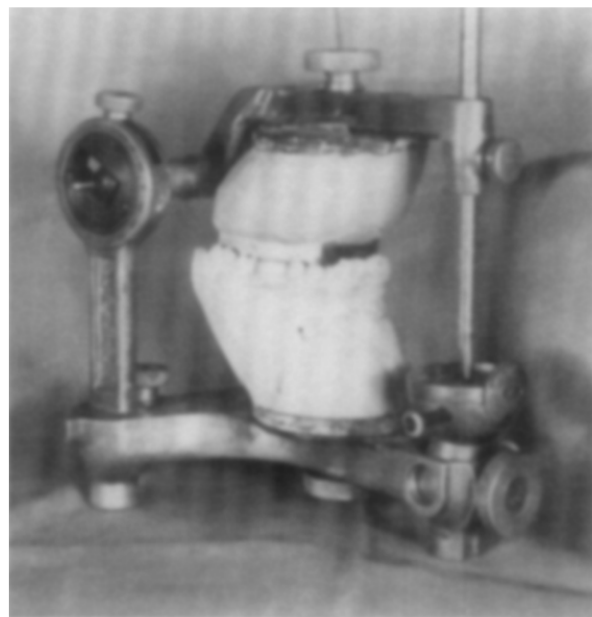


Fig. 7. Razor blades reinforced with dental stone in maxillary arm of articulator. Movement of maxillary arm creates working and balancing occlusions.



Fig. 8. Completed mandibular restorations.

the working and balancing occlusions (Fig. 7). The occlusal surfaces of the restorations conformed to the working and balancing occlusions. All cusps were eliminated. The masticatory effectiveness was obtained by creating sluiceways, embrasures, and grooves. Figs. 8 and 9 illustrate the completed restorations, while Fig. 10 shows the reconstruction in situ. The result has been excellent. It is now 37

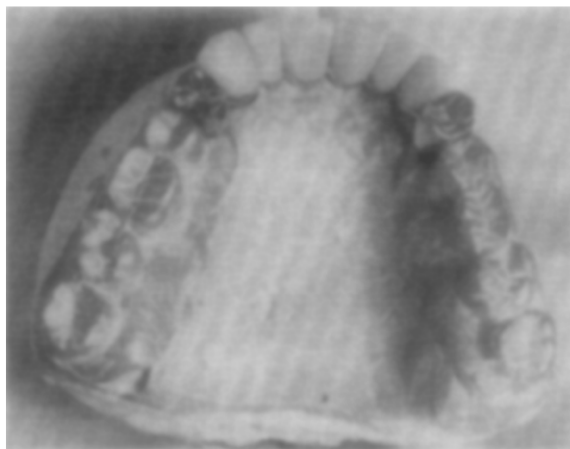


Fig. 9. Completed maxillary restorations.



Fig. 10. Completed reconstruction in situ.

years since treatment, and the reconstructed dentition continues to function well.

## SUMMARY AND CONCLUSIONS

Many concepts and theories have been propounded to enhance reconstruction of the dentition. Some have been put to practice; others have been rejected.

All reconstructive procedures must be acceptable to the TMJ, the neuromuscular complex, and the periodontium. A correct centric relation and vertical dimension are critical to success.

A major objective is to provide adequate function. The concept of occlusion and related articulation seems to play a secondary role. The best result occurs when the patient is unaware of the oral cavity and enjoys the esthetic result.

A usable articulator should accept the face-bow

and wax interocclusal records as well as provide for adjustable condyle paths, incisal table, and a form of Bennett movement. Once adjusted, it should retain the position.

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