## Thoughts on Occlusion

# Accuracy of Dental Articulators

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Modern occlusal concepts probably begin with the works of Bonwill who was inspired by Carabelli (1–5). Bonwill was soon followed by Spee who first described the mechanics of mandibular function which he saw as circular in motion, a section of a cylinder (6). Gysi may have invented the first compound dental articulator (7). Hanau offered the earliest complex concept of occlusal dynamics and designed an articulator based upon his thoughts (8).

Many dental articulator designs have followed, each with its own unique design and each offered to serve one of the many evolving dental occlusal philosophies. Regardless of the specific design, almost all adjustable dental articulators have three common features: 1) they are the same size; 2) they are rigid; and 3) they are, basically, linear in movement.

In a recent series of articles, Presswood showed functional occlusal movements to be non-linear and parabolic in nature (9–2). In earlier papers, the articular complex of temporomandibular joint (TMJ), bone, and periodontal ligament (PDL) was shown to be compressible and flexible (13–16).

A series of comparison studies were undertaken using a randomly-selected group of dentists.* Each of the participants used the articulator of his choice and mounted casts of his teeth following guidelines of the occlusal philosophy and/or technique of his choice.

In small groups (5–10), each participant was closely examined for occlusal function. The teeth were marked with silk occlusal ribbon and photographed. All participants displayed balancing (non-functioning) side tooth contacts, many with balancing side group function (17). Working side group function was common. All participants initiated functional movements from maximal intercuspal position (MIP). There were no incidents of coincident centric relation (CR)/MIP.

When the articulated models were examined, all function initiated at CR with a required slide to MIP. In lateral motion, there were no instances in which the articulator duplicated the observed intraoral patterns of contact and dynamics of motion. Most lateral contact was in the anterior (bicuspid forward) area of the occlusion, and there were no balancing side contacts.

If the dental casts were held in hand, some, but not all, of the observed intraoral contacts could be duplicated.

The rigidity and linear physical nature of the articulators would not allow the same pattern of motion seen intraorally. The non-flexibility and incompressibility of hand held dental stone casts prevented the duplication of the contacts seen intraorally even though the contacts that were generated were more like those seen in the mouth than those generated by the articulators.

From these observations it is reasonable to conclude the following:

1. While CR is a convenient reference with which to transfer and mount dental study casts, it is not necessarily a point of function.
2. All functional activity in these observations originated at MIP.
3. All adjustable dental articulators are linear and rigid and will not replicate functional movements of the dentition.
4. It is inconceivable that any dental restorative case can be made in any dental articulator and placed in intra-oral function with occlusal harmony without post placement refinement (intra-oral occlusal adjustment).

While dental articulators are significant aids in visualizing dental function, in learning occlusal concepts and in diagnosing occlusal discrepancies, they are not sufficiently sensitive by themselves to allow construction of fully functional dental prostheses.

* All participating dentists were mature clinical practitioners with many years of occlusal study in different occlusal philosophies. All were very cooperative, but most were skeptical of the hypothesis, which was described just prior to examination.

## References


1. Bonwill WGA. Geometrical and mechanical laws of articulation: anatomical articulation. Trans Odont Soc Penns 1885; p.109-33.
2. Bonwill WGA. The geometrical and mechanical laws of the articulation of the human teeth-the anatomical articulator. In: Litch F, ed. The American System of Dentistry. Volume 2. Operative and Prosthetic Dentistry, Part 2. Prosthetic Dentistry. Philadelphia: Lea Brothers; 1887: 486-98.
3. Bonwill WGA. What has dentistry to demonstrate against the hypothesis of organic evolution. Chicago: Knight Leonard; 1894.
4. Bonwill WGA. The scientific articulation of the human teeth as founded on geometrical, mathematical and mechanical laws: the anatomical articulator. Dent Items of Interest 1899; 21:617-43, 873-80.
5. Carabelli G. Systematiches Handbuch der Zahnheilkunde. Wien: Braunmüller und Seidel; 1844.
6. Spee F. Die Verschiebungsbahn des Unterkiefers am Schädel. Ger Arch Anal Phys 1890; 285-94.
7. Gysi A. The problem of articulation. Dent Cosmos 1910; 52:1-19, 148-69, 268-83, 403-4.
8. Hanau R. Five factors governing occlusal function. In: Full Denture Prosthesis, 4th ed. Quintessence; 1930.
9. Presswood RG. Cusped teeth — an anthropological anachronism. Tex Dent J 2005; 122(1):98-9.
10. Presswood RG. Digital laser scans used in the morphometric analysis of human skulls to demonstrate dental occlusal function-part I. Tex Dent J 2005; 122(4):382-3.
11. Presswood RG. Digital laser scans used in the morphometric analysis of human skulls to demonstrate dental occlusal function-part II. Tex Dent J 2005; 121(7):680-3.
12. Presswood RG. Digital laser scans used in the morphometric analysis of human skulls to demonstrate dental occlusal function-part III. Tex Dent J 2005; 122(12):1236-8.
13. Shannon EJ, Leff A. Mandibular and articular movements, part III. J Prosthet Dent 1962; 12(1):82-5.
14. Moss ML. A functional cranial analysis of centric relation. Dent Clin North Amer 1975; 19(3):431-42.
15. Zola A, Rothschild EA. Posterior condyle positions in unimpeded jaw movements. J Prosthet Dent 1962; 11(5):873-881.
16. Zola A. Morphologic limiting factors in the TMJ. J Prosthet Dent 1963; 13(4):732-40.
17. Le Gall MG, Lauret JF. The function of mastication: implications for occlusal therapy. Pract Periodontics Aesthet Dent 1998; 10(2):225-9.


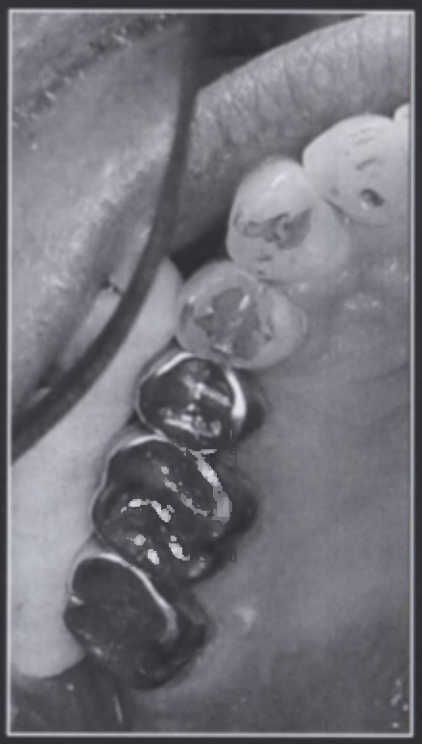

**Figure 1.** Intra-oral photograph showing fully balanced occlusion.

**Figure 2.** Mounted and hand-held casts do not show same patterns of function or duplicate intra-oral paths of function.