Introduction to the Panadent System

Prosthodontics has changed significantly over the years to the point where patient's acceptance or requests for complete removable dentures has been replaced with requests to save the natural dentition with restorative and fixed prostheses, including implants. The relationship of teeth, TM Joints and neuromuscular system is being increasingly recognized as important factors in fixed prosthodontics as well as orthodontics. Concurrently, the need for user-friendly articulators that simulate individual patient's characteristic jaw movements has increased.

Using a point midway between the lateral and medial condyle pole to represent the path of the condyle, research shows that the condylar movements of one patient are similar in certain aspects to those of others. For example, beyond the lateral functional range (3mm from centric relation) contralateral condyles, in the horizontal plane, show similar orbiting paths of about 6-7°. The curvature of protrusive and lateral border paths in the functional range, in the sagittal plane, are approximately ¾" radii. The lateral border and protrusive paths of contralateral condyles, in the sagittal plane, are usually identical in the functional range (3mm). The paths of ipsilateral condyles are primarily horizontal and/or pivotal in the functional range (3mm).

In the lateral functional range (3mm), condylar movement patterns differ primarily in two aspects: (1) the radius curvature of the lateral border path of the contralateral condyle in the horizontal plane and (2) the steepness of the lateral border and protrusive path in the sagittal plane.

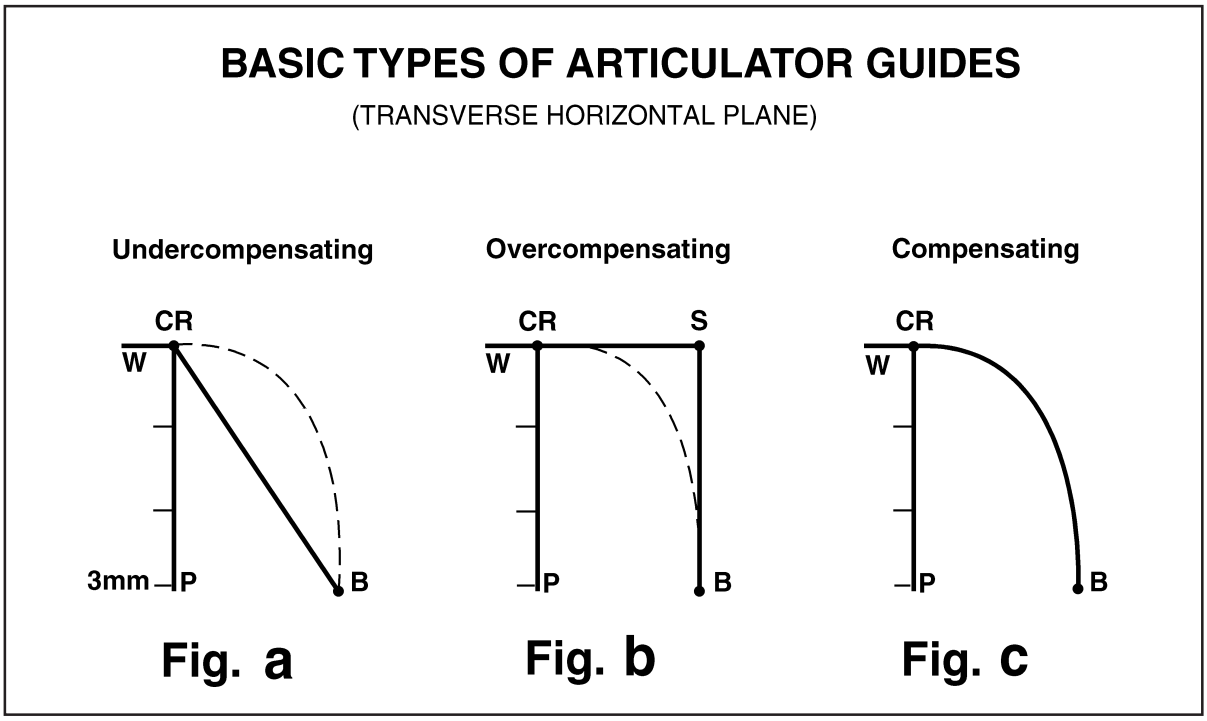
Research shows that under functional loads, patients' condylar movements on the contralateral side are not straight paths. The paths curve simultaneously in the three planes of space. Jaw movement studies also show that contralateral condylar paths create the major differences between patients' lateral jaw movements in the functional range (3mm). The ipsilateral condylar paths (Bennett) are primarily horizontal and/or pivotal in the functional range (3mm).

Over the years, attempts have been made to compensate for the curved contralateral paths observed and recorded on patients by various methods. Some manufacturers have incorporated a variable straight-line "side shift" in their articulator guides (Fig. **b**). The contralateral condylar element, (Fig. **b**), does not begin its detrusive movement until after the "side shift" has ended at point "S". Thus a pure horizontal movement takes place on the articulator. In some instances these horizontal articulator movements encompass almost the entire occlusal width of the posterior teeth. Negative effects of horizontal straight line overcompensating "side shift" articulator movements (Fig. **b**) include:

(1) Articulators that become awkward to manipulate
(2) Unnatural mandibular motion simulation
(3) Possibilities of producing low profile (flattened) occlusal surfaces which may overload patients' temporomandibular joints, teeth, muscles, periodontia, ridges, implants, and prostheses during function.

Compensating curved contralateral articulator paths (Fig. **c**) are superior because:

(1) Research shows the articulator movements more closely simulate those of the individual patient.
(2) They enable dentists, technicians, and students to observe realistic movements of the mandible as it translates and rotates simultaneously in three planes of space (six degrees of freedom of motion).
(3) The articulators are easier to manipulate (user-friendly) during diagnosis as well as constructing artificial occlusal surfaces.
(4) Curved paths help dentists and technicians create better occlusal forms while concurrently



A functional border path of the contralateral condylar element is represented by the dotted curved lines in (Figs. **a** and **b**), and the solid curved line (Fig. **c**). The path from CR to B (Fig. **a**) represents an undercompensating straight line contralateral guide. The solid rectilinear line CR-S-B (Fig. **b**) represents an over-compensating straight line, pure horizontal "immediate side shift" guide. (Fig. **c**) represents the compensating curved path guide. The letter P in each of the three types represents protrusive movement. The letter W represents ipsilateral movement (Bennett) which is primarily horizontal in the functional range (3mm).

The major disadvantage of "straight line" undercompensating articulators is that most patients' condylar movements under functional load (dotted line) exceed the border limits of the straight path guides CR-B (Fig. **a**). This undercompensation creates potential posterior occlusal interferences of a prosthesis when placed under functional loads in the mouth.

PANADENT PREFORMED CONDYLAR AXIS MOTION ANALOGS

The Panadent Articulator System is the direct result of the most advanced research in mandibular motion simulation (see Bibliography). It is based upon information gathered from hundreds of patients' transverse (horizontal) condylar axis motion analogs. The end result is a scientific rationale for uncomplicated, high fidelity, user-friendly, instrumentation for simulating individuals characteristic jaw movements.

A series of statistically selected three-dimensional analogs of condylar axis motions are preformed in resin. They include the curved, protrusive and curved lateral border pathways. The series of analogs come in five sizes, each with increasing curvatures of contralateral condylar Bennett movement: 0.5, 1.0, 1.5, 2.0, 2.5mm, for right and left sides. The half millimeter increments are measured at a point 3mm forward in the sagittal plane from centric relation position where a vertical line intersects the condylar pathway. The motion analogs can be rotated individually in the sagittal plane to match the protrusive and lateral border pathways recorded on the patient.

The analogs can also be selected so that the right and left sides have different sized curvatures of contralateral condylar movement. Since patients' condylar paths are primarily horizontal and/or pivotal, in nature, the Panadent preformed motion analogs are produced with horizontal (transtrusive) paths on the ipsilateral side.

The Panadent analog articulator is a precision instrument designed to meet the needs of students of occlusion as well as dentists in advanced clinical practice. The Basic Articulator Module includes one pair of motion analogs. Based on research, the 1.5mm analogs fit the largest percent of the population (90%, see Fig. f).

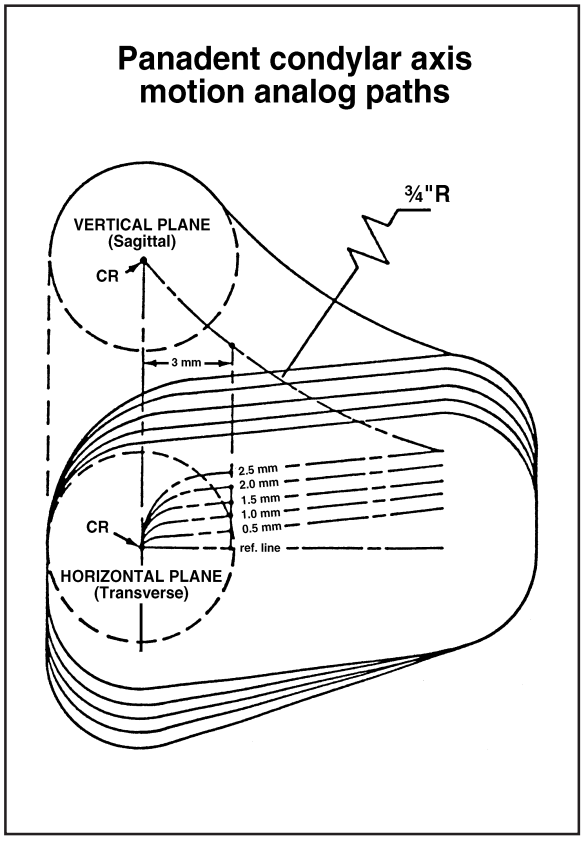


Fig. d
Schematic illustration of Panadent preformed Intercondylar Axis Motion Analogs. Note the variations in the curved contralateral paths in the functional range of 3.0mm from centric relation (CR) in the horizontal plane. The curve pathway in the vertical plane averages ¾"R. The orbiting paths beyond the 3.0mm point are caused by the generally pivoting ipsilateral condyle when the mandible is forced into extreme movements. These orbiting paths are of no clinical significance in lateral function. The frontal plane paths are not shown (to avoid line confusion) but are similar to the horizontal (transverse) plane characteristics.

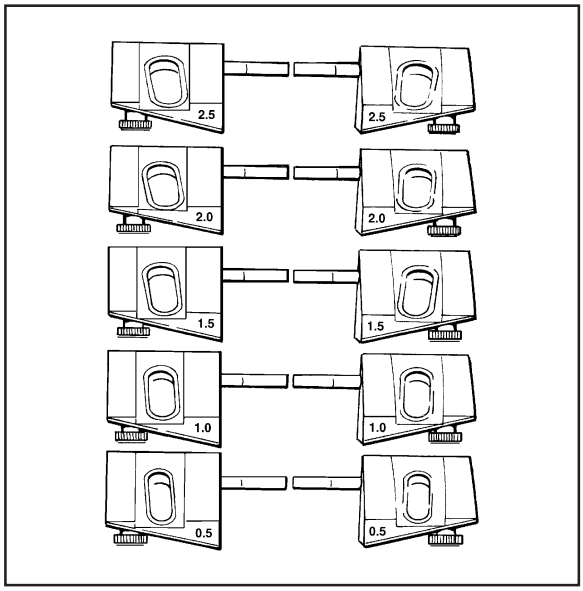


Fig. e
A complete set of Panadent preformed Condylar Axis Motion Analogs showing 0.5mm on the bottom and increments of 0.5mm to the maximum size of 2.5mm on the top. The right and left analogs may be used in any combination to allow for differences between the right and left side of the patient. The analogs may be rotated individually to duplicate the patients condylar axis path.

Distribution of Bennett Movement

OPERATOR INDUCED

millimeters per side *	.25	.5	1	1.5	2	2.5
Percent (%) of Patients	2	15	52	21	8	2

* Rt. & Lt. border movements measured on the non-working side 3mm forward on the vertical and horizontal planes from centric relation.

Fig. f
Distribution chart for 220 patients right and left lateral jaw movements (total of 440 individual border movements) recorded with the Lee Research Axiopantograph.

PANA-MOUNT ™ FACE-BOW:

The Pana-mount Bow has been designed and engineered to be, strong, fast, easy to use, face-bow and comfortable for the patient.

The bow can be used as an ear-bow for average-axis mounting, but also has provisions for adding adjustable axis arms for true hinge-axis mounting. It also has a detachable indexed bite-fork assembly and mounting fixture which eliminates the need for attaching the face-bow directly to the articulator. By having extra bite-fork assemblies, the bow can be used immediately for other patients and the casts may be mounted at a later time.

PANADENT JAW POSITION INTEROCCLUSAL RECORD SYSTEM

It has long been recognized that wax “check-bite” records have many shortcomings and are unreliable in clinical practice. This manual presents a non-wax method for making accurate centric relation and protrusive inter-occlusal records for mounting patients’ casts and adjusting the articulator.

The Panadent Interocclusal Record System is based on the Lee method. It uses a preformed soft metal tray (Bite-Tray™) for conveying Bite Registration material to the teeth as well as a compound (modeling compound) lower anterior tooth position index. Softened compound allows the operator to index the lower anterior teeth in either a retruded (CR) or a protruded position. When hardened the compound index enables the patient to repeat and hold the desired mandibular position while the interocclusal registration material is hardening.

BIBLIOGRAPHY FOR PANADENT PRE-FORMED INTERCONDYLAR (HINGE) AXIS MOTION ANALOGS AND AXI-PATH RECORDER

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THE PANADENT MODULAR ARTICULATOR SYSTEM PROVIDES:

I. User-friendly, sophisticated instrumentation for jaw movement simulation.

2. An articulator system that meets the requirements of both removable and fixed prosthodontics as well as orthodontics.

3. An articulator that is as uncomplicated as a straight line adjustable articulator yet reproduces most major mandibular motions with condylar curved paths in three planes of space ("six degrees" of freedom of movement).

4. Major parameters of mandibular movement controls include curved lateral border Bennett and protrusive pathways.

5. Five wall analog guides for each condylar axis element for producing the rhombus geometrics and the envelope of motion.

6. Fixed condylar axis elements rather than "adjustable intercondylar distance."

7. A DYNA-LINK system for keeping upper and lower articulator frames joined together in eccentric movements as well as centric relation position.

8. An arcon type articulator that opens 180° while the frames remain joined together.

9. Interchangeability of mounted casts from one articulator to another (PCH and PSH models).

10. An articulator upper frame that can be locked to the lower frame for centric axis motion during mounting and remounting procedures.

11. A unique interocclusal record (check bite) method for adjusting articulator pre-formed condylar motion analogs to the proper protrusive angulation and Bennett shift.

12. An average-axis face-bow (ear-nasion) with a mounting fixture which does not require the face-bow to be joined to the articulator during mounting procedures.

13. An articulator modular system that can be expanded to include the Panadent AXI-PATH (Ana-Digit) Recorder and true condylar axis mounting as well as the API and CPI system for tracking condyle positions before and during treatments.

14. A modular system that will adapt to new Panadent peripherals including: ***Magna-Split*** (magnetic mounting plates), ***Bio-Esthetic*** Level Gauge, and Magnetic bite fork support system for supporting the bite fork.

15. A molded plastic carrying case which holds the complete system including: instruction manual, articulator, face-bow and mounting stand, plus space for study casts and other auxiliary items.