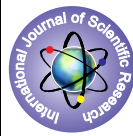


## Philosophy and Physics of Mandibular Hinge Axis: A Review



### Medical Science

**KEYWORDS :** Hinge axis; Mandibular axis; Terminal hinge axis.

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### ABSTRACT

*The area of dentistry pertaining to hinge axis, temporomandibular joint and mandibular movements has been presented as involving controversial views. The article presents a brief overview of the historical aspect and the ideas about hinge axis collectively to enable the reader to interpret the topic in view of existing concepts.*

### INTRODUCTION

Temporomandibular joint presents freest range of excursions of any of the body joint. The mandibular hinge axes controls the movements of the mandible and hence influence the contacting positions of the teeth. The analysis of condylar movement reveals that translatory and rotational components in varying proportions affect the path and location of the condyles in movement. The mandibular movement path is the combined effect of rotation and gliding path of the axis. Hinge axis is the imaginary line around which the working condyle rotates during lateral mandibular movement with sagittal and vertical axes functioning concurrently.

### Schools of thought regarding hinge axis theory

#### 1. Absolute location of the hinge axis

It is believed that the hinge axis is a component of all masticatory movements of the mandible and is to be considered for every mandibular movement.

#### 2. Arbitrary location of the hinge axis

It is believed that the hinge axis is of considerable value, but it is not worth the effort to locate. It is not of significance if the hinge axis of the articulator does not coincide with the hinge axis of the patient.

#### 3. Nonbelievers in the transverse axis location

It is believed that the hinge axis is only theoretical and not practical. It can't be accurately located and can't be reproduced by one axis of an articulator. Hence an arbitrary axis is acceptable.

#### 4. Split axis theory

It is believed that there are two separate hinge axes of rotation, one in each condyle and they exist parallel to each other.

### Clinical significance

The hinge axis provides the means to reproduce mandibular movements on the articulator. It enables transferring the patient to the laboratory bench. Hinge axis is located by a series of controlled opening & closing movement of the mandible when it is held in its most retruded position in relation to the maxilla. The location of the terminal hinge axis is mainly related to the accurate transfer of centric relation record. The condylar axis has to be located and duplicated on the articulator as the basic requirement for successful occlusal therapy is comfortable condyles. There is a need to accurately locate the hinge axis to enable the accurate reproduction of occlusal relationships on an articulator.

### DISCUSSION

Movement of any solid body is depicted by at least three points of guidance to orient and reproduce its motion. Every rotating body turns upon some fixed or imaginary line. Similarly the path of movement of three separate points can orient and simulate mandibular movements. Bennett stated that movement of mandible does not consist simply of rotation about condyle. The curves formed by successive positions of moving condyle vary considerably among individuals. The movement of mandible is independent of individual slope of articulating surfaces of temporomandibular joint, especially the posterior slope of articular eminence.<sup>1</sup> Mandibular action and guidance are almost purely neuromuscular and temporomandibular joints are primarily accommodative. The adaptive mechanisms permit fitting the body of mandible with its teeth masses to its work. Physiologically mandible has more than three points of control. Intraborder movements of mandible are greatly variable within envelop of motion.

Campion emphasized the importance of locating the terminal hinge axis in mounting casts on articulator.<sup>2</sup> It is significant that the axis of articulator shaft should coincide with mandibular terminal hinge axis of the patient.<sup>3</sup> It is accepted without doubt that the condyles are asymmetrically sized, shaped, and positioned. Anatomically the condyles are joined at the symphysis and not by any connective tissue mechanism running through the head from one condyle to the other condyle. The condyles, which are irregular bodies, have imaginary hinge axes which pierce them transversely, horizontally & sagittally. Infinite number of physiologic guiding factors around these axes produces coordinated mandibular movements.

It is generally denied that a hinge axis is constant to the mandible or to the articulator disc even in simple rotation and in complex movements involving combination of rotary and translator movement. It is agreed that even the most developed articulator do not purely reproduce all of the complex mandibular movements in the biological entity such as masticatory system. Also, as a mechanical device, articulator movement is rigid & unyielding in contrast to the innumerable movement coordinates made by the mandible during all of its functional and parafunctional activities. Articulators only approximate the dynamic characteristics of functional jaw movements.

Granger & McCollum hold that hinge axis location with a high degree of accuracy is possible.<sup>4,5</sup> However, Kurth & Feinstein concluded that the hinge axis could not be located on a patient with any high degree of accuracy.<sup>6</sup> Brotman demonstrated that an error is incorporated at occlusal surfaces when there is discrepancy between the articulator hinge and anatomic hinge. This error in closure is shown to increase proportionately as the deviation of articular hinge from the anatomic hinge increases. This emphasizes the need for accurate hinge axis location in

order to produce accurate occlusal relationships on the articulator.<sup>7</sup> Bennett showed that no single rotation center existed, but that the centre of rotation changed constantly. It has also been shown that reasonable errors in terminal hinge axis location produce anteroposterior mandibular displacement to some extent when the centric relation record is transferred onto the articulator.<sup>8</sup>

## CONCLUSION

The terminal hinge movement is important as a reference movement because the positions on this path of movement are reproducible. It is recorded for verification of maxillomandibular relationship as it is required to design any restoration for oral rehabilitation. Knowledge of biologic and mechanical factors exercised by neuromuscular system for mandibular movements and jaw closure helps to utilize the mandibular hinge axis for planning oral rehabilitation.

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