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Curve Of Spee in Orthodontic

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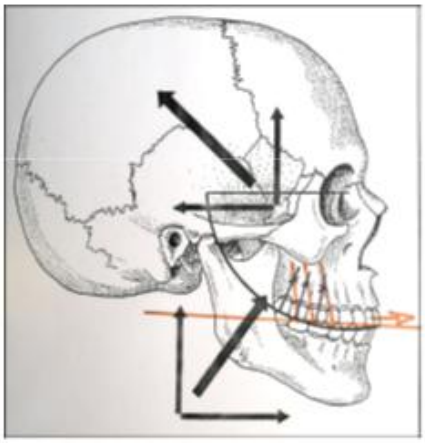
Abstract: *Curve of Spee is a naturally occurring phenomenon in the human dentition. This normal occlusal curvature is required for an efficient masticatory system. Orthodontists eventually deal with the curve of Spee in virtually every patient they treat. The aim of this review was to increase our knowledge regarding the development and effects of carve of Spee on dentition and its treatment in exaggerated cases. It would be useful if we have a thorough knowledge of how and when this curve of Spee develops, so that it will help the orthodontists during treatment of their cases.*

Keywords: *carve of Spee, orthodontic treatment, mandibular teeth, leveling, occlusion*

I. Introduction

Occlusion is defined a manner in which the upper and lower teeth intercuspate between each other in all mandibular positions and movements. It is a result of neuromuscular control of the components of the mastication systems namely: teeth, periodontal structures, maxilla and mandibular, temporomandibular joints and their associated muscles and ligaments (Ash & Ramfjord, 1982). Curve of Spee has been defined as the anatomic curve established by the occlusual alignment of the teeth. It was first described by F Graf Von Spee in 1890, which used skulls with abraded teeth to define a line of occlusion. This line lies on a cylinder that is tangent to the anterior border of the condyle, the occlusal surface of the second molar, and the incisal edges of the mandibular incisors. Spee located the center of this cylinder in the mid-orbital plane.



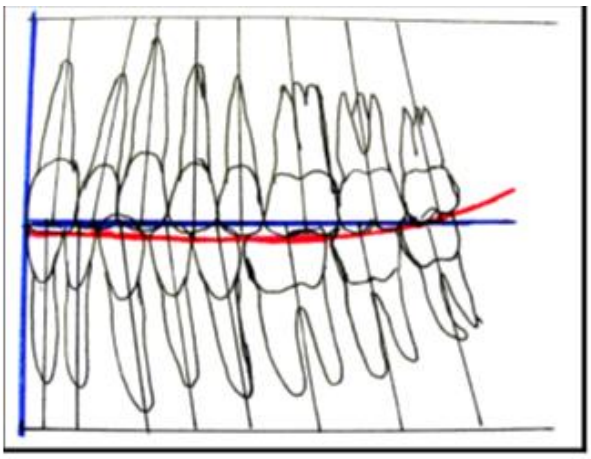


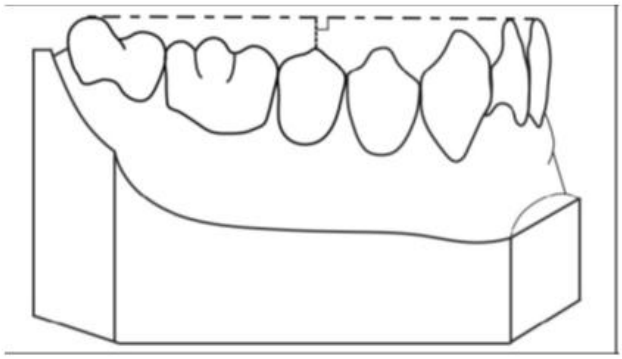
Figure 1; shows carve of Spee in relation to the skull.
Figure 2; shows carve of Spee in relation to the maxillary and mandibular teeth.

The definition of the Curve of Spee, by the textbook of anatomy (Schumacher GH) " it is defined as that curve, which is connecting the edges and cusps of the upper teeth and is targeting the distal part of the condyle (Figure 1). While "The principle of the curve of Spee consists in getting a good position of occlusal surfaces of these teeth, against the main force vector of masticatory muscles for a physiologic function (Figure 2). Clinically in orthodontics today, the curve of Spee refers to the occlusal curvature of the mandibular dentition that runs tangent from the buccal cusp tips of the posterior molars to the incisal edges of the anterior incisors when viewed in the sagittal plane (Figure 2).

The morphological arrangement of the teth in the sagittal plain has been related to the slope of the articular eminence, craniofacial morphology, lower incisor proclination, the incisor overbite, the molar cusp height and lower arch circumference. However it is suggested that the curve of Spee has a biomechanical function during food processing by increasing the crush-shear ratio between the posterior teeth and the efficiency of Occlusal forces during mastication. Andrews described the six characteristics of normal occlusion and found that the curve of Spee in subjects with good occlusion ranged from flat to mild, noting that the best intercuspation occurred when occlusal plane was relatively flat. He proposed that flattening the occlusal plane should be the treatment goal in orthodontics. This concept especially as applied to deep overbite patients, has

been supported by others (Tweed CH, 1966) (Schudy FF, 1968) (Burstone, CR 1977) (Koyama TA, 1979) (Otto RL, 1980) (Garcia R, 1985). It has been suggested that the deciduous dentition has a curve of Spee ranging from flat to mild, whereas the adult curve of Spee is more pronounced. The development of curve of Spee probably results from combination of factors including eruption of teeth, growth of orofacial structures, and development of neuromuscular system.

In the field of orthodontics, it is often of more interest, and is altogether more practical, to study the dentitions of living patients. Typically the curve of Spee has been measured outside of the patient's mouth using one of two methods: orthodontic study models, and/or lateral cephalometric images A more simplified and common clinical method of quickly evaluating the curve of Spee using study models is to lay the mandibular cast upside-down on a flat surface such that the model would be tripoded on the most extruded molar cusps on the right and left sides posteriorly and the most extruded incisor tip anteriorly (Braun et al, 1996). From here, the depth of the curve can then merely ranked in severity (mild/moderate/severe) or precisely measured.



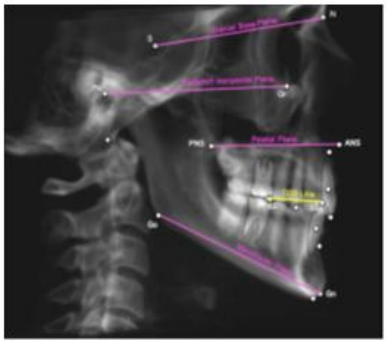


Figure 3; shows carve of Spee in mandibular cast
Figure 4; shows carve of Spee in Cephalometic/ lateral view X-ray

Evaluation of the curve of Spee has also taken place with the use of lateral cephalometric radiographs. The same principles apply, where some form of a curve of Spee line joining a molar cusp and incisor tip is used as a reference plane and the distance to the most intruded premolar is measured either by a ruler on a plain film, or by a computer software program on a digital film (Bernstein et al, 2007).

(Andrews 1972) noted that in non-orthodontic normal subjects, the occlusal plane ranged from flat to a slight curve of spee. He discussed a natural tendency for deepening of the curve of spee with aging; with continued growth of the mandible beyond that of the maxilla, the mandibular incisors restricted by the maxillary incisors would be forced to move backwards and upwards. While the correction of an excessive curve of Spee, may presented a challenge to the orthodontist.

Leveling of the occlusal plane is almost always indicated and according to (Proffit, 2007) should be performed as a part of the first major stage of comprehensive orthodontic treatment. A variety of the techniques for leveling is available, and involves either extrusion of premolars and molars, intrusion of incisors, or by some combination of both. The method selected should be based on the specific characteristics of not only the patient's malocclusion, but also their overall craniofacial proportions (Proffit, 2007).

Exaggerated curve of Spee is frequently observed in dental malocclusions with deep overbites. Such excessive curve of Spee alters the muscle imbalance, ultimately leading to the improper functional occlusion. It has been proposed that an imbalance between the anterior and the posterior components of occlusal force can cause the lower incisors to over-erupt, the premolars to infra-erupt, and the lower molars to be mesially inclined.

II. Leveling the curve of Spee

Leveling of the curve of Spee is one of the important aspects of comprehensive orthodontic treatment. It is usually accomplished by anterior intrusion or posterior extrusion. While leveling of the occlusal plane is an essential component of nearly every orthodontic treatment case. It is necessary as a part of the traditional goals to achieve ideal anterior open bite and overjet relationships, proper posterior intercuspation, and an overall result that is both functional and esthetically appealing. With the knowledge of how a particular orthodontic appliance or technique causes actions and reactions of teeth and other facial components Several authors have suggested that leveling requires additional arch length. (Baldrige1996) and (Braum et al, 1996) found a linear relationship between arch circumference and the amount of leveling. They predicted a ratio somewhat less than 1:1 between the depth of the Curve of Spee and the amount of arch circumference needed to level the curve Accordingly, arch leveling occurs mostly by an extrusion of the lower premolar teeth in conjunction with a minimal intrusion of the mandibular incisor teeth.

Extrusion of posterior teeth

A very common method is the use of continuous archwires in extrusion of posterior teeth. Other common methods include the use of a bite plate, which allows the posterior teeth to erupt. Extrusion of posterior teeth is indicated in patients with short lower facial height and excessive curve of spee. In a long-faced individual, it would be an unfavorable effect to have molar extrusion leading to down and backward rotation of the mandible, as it would worsen the face height proportions. Therefore, in an adolescent patient with a horizontal or normal vertical growth pattern, posterior extrusion may be a better choice.

Intrusion of incisors

Intrusion of upper and/or lower incisors is a desirable method to level curve of Spee in many adolescent and adult patients (Nanda et al, 1998) (Melsen et al, 1988) (Melsen et al, 1986). It is particularly indicated in patients with a large vertical dimension, excessive incision-stomion distance, and a large interlabial gap. If incisor intrusion is desirable, it would be wise to avoid the use of a posterior bite opening prop to encourage maximum effects of the anterior bite plane or turbo effect of the maxillary lingual brackets. However if molar extrusion and resultant mandibular rotation is undesirable, than the use of a posterior bite opening prop might be in the patient's best interest. If incisor proclination is not favorable, then the archwires could be cinched to avoid this side effect.

In an adult patient with less vertical growth potential, anterior intrusion within the physiologic limits-seems the likely choice to level the dental arch because any posterior extrusion in such a patient is prone to relapse. But anterior intrusion has its own disadvantages. A major risk factor associated with anterior intrusion is apical root resorption (Parker RJ et al, 1998), (Faltin RM, et al, 1998). It has been suggested that 1 mm of space is needed to level each 1 mm of the curve of Spee (Rakosi T et al, 1993) Segmented arch mechanics have previously been used for anterior intrusion (Burstone CR, 1977). Segmented arch mechanics can be used for both anterior intrusion and posterior extrusion to level the dental arch without causing incisor protrusion. Leveling the dental arch does not necessarily increase arch length requirements. About 3 mm to 4 mm of total arch length may be gained by leveling a deep curve of Spee through molar up-righting. (Bench et al, 1978).

The stability of leveling curve of Spee may be dependent on the specific nature of its correction. The stability of posterior extrusion is controversial. Variables such as the amount of growth and the patient's age during treatment, muscle strength, adaptation, and the original malocclusion have all been postulated as factors contributing to the long-term stability of correction of curve of Spee (Berg R, 1983). Burzin and Nanda (1993) specifically investigated the stability of incisor intrusion and found that maxillary incisor showed insignificant relapse.

According to (Praeter et al, 2002), leveling the curve of Spee during orthodontic treatment seems to be very stable on a long-term basis.

III. Conclusion

From this review the following conclusion can be drowning;

1- The understanding of curve of Spee in the field of orthodontics is very important as orthodontists deal with it in virtually every patient they treat.
2- The correction of curve of Spee in a non-growing individual always poses a great problem to the orthodontists.
3- Positive correlation between overjet and curve of Spee and between overjet and arch circumference. On other hand, negative correlation between arch circumference and curve of Spee

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