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ORIGINAL STUDY

CURVE OF SPEE IN PHYLOGENY AND THE EXPRESSION OF THE TYPE OF ACTIVITY OF THE MASTICATORY SYSTEM

Ioana Grigorescu[1], Anca Temelcea[2], Radu Stanciu[2], Dragoş Stanciu[2], Elvira Dumitrascu – Patroi[2]

[1] PhD- Student, University of Medicine and Pharmacy „Carol Davila" Bucharest, Romania
[2]Department of Orthodontics University „Carol Davila" Bucharest, Romania

drioanadurbaca@yahoo.com

ABSTRACT

Object of the study: determining the value of the curve of Spee in the propulsion or laterality movement and the involvement of the curve of Spee in the genesis of the 2nd class in humans. A series of bovine and rodents skulls were selected for this study from the laboratory of Compared Anatomy from the faculty of Veterinary Medicine The analysis of the anatomical criteria at the level of the dentoalveolar apparatus was in 2 types of herbivores, namely: the common cow, from the Bovidae family, Bovinae subfamily and the rabbit from the Leporidae family, Lagomorpha order. We analysed the dental formula and its changes in relation to the dental formula of mammals, as well as the specialisation of teeth according to the type of food. Anatomical aspects highly resemble in cows and sheep.The principal findings of this study are : the analysis of the occlusion reveals a neutral relation in the sagittal plane, with "end-to-end" incisor contact and a molar occlusion plane, posterior and superior inclined, but in a direct line, without any vertical gaps in the premolar - molar group. Transversally, there is an increased dimension of the upper arcade which gives freedom to the mandible in the propulsion movements. In the end-to-end frontal relation, there is desocclusion of the lateral areas, the contact being done strictly in the frontal area.The curve of Spee is useful in laterality movements and along with the condylar pattern, blocks any type of mandibular movement in the sagittal plane. Analysing the recovery orthodontic techniques of the Angle 2nd class and regarding the phylogenetical argument, we can assume that the existence of the curve of Spee in children is a very important anatomical factor in the genesis of the 2nd class anomaly.

KEYWORDS*: phylogeny, curve of Spee, herbivores, rodents, propulsion and retro- propulsion movements.*

1. Introduction

Viewed in the sagittal plane, occlusal curvature is a naturally occurring phenomenon in the human dentition. Found in the dentitions of other mammals and fossil humans, this curvature was termed the curve of Spee in the late 19th century, when Ferdinand Graf von Spee described it in humans [1,2]. Today in orthodontics, the curve of Spee commonly refers to the arc of a curved plane that is tangent to the incisal edges and the buccal cusp tips of the mandibular dentition viewed in the sagittal plane. Andrews, [3] in describing the 6 characteristics of normal occlusion, found that the curve of Spee in subjects with good occlusion ranged from flat to mild, noting that the best static intercuspation occurred when the occlusal plane was relatively flat.

He proposed that flattening the occlusal plane should be a treatment goal in orthodontics. According to several studies [4,5] this concept, especially as applied to deep overbite patients, has been supported and produces variable results with regard to maintaining a level curve after treatment.

The occlusal plane in the deciduous dentition is relatively flat. The largest increase in the maximum depth of the curve of Spee occurs during, and results specifically from, the differential eruption of the mandibular permanent first molars and incisors relative to the deciduous second molars [4,6,7]. The curve of Spee maintains this depth until the mandibular permanent second molars erupt above the occlusal plane, when it again deepens. During the adolescent dentition stage, the curve decreases slightly and then remains relatively stable into early adulthood. There are no significant differences in maximum depth of the curve of Spee between either the right and left sides of the mandibular arch or the sexes [8,9]. It is very common to cite the curve of Spee and its possible implications in the determination of the functional relations in omnivorous. Phylogeny, on the other hand, selected over long periods of time, through specialisation, the pattern of occlusal relations, according to the type of food and, implicitly, the pattern of jaw movements in mammals [10].

Comparing the two points of view, we can notice a substantial gap between the phylogentical reality and the pattern of scientific explanations. In this study we determined the value of the curve of Spee in the propulsion or laterality movement and the involvement of the curve of Spee in the genesis of the 2nd class in humans.

2. Material and Methods

A series of bovine and rodents skulls were selected for this study from the laboratory of Compared Anatomy from the faculty of Veterinary Medicine. The selected subjects were previously examined and found to be adequate for research purposes taking into consideration the fact that the skulls dentition did not present any sign of distortion or abrasion.

The analysis of the anatomical criteria at the level of the dentoalveolar apparatus was in 2 types of herbivores, namely: the common cow, from the Bovidae family, Bovinae subfamily and the rabbit from the Leporidae family, Lagomorpha order.

We analysed the dental formula and its changes in relation to the dental formula of mammals, as well as the specialisation of teeth according to the type of food.

3. Results and Discussions

The cow has 6 teeth on the lower jaw: 2 central incisors, 2 lateral incisors and 2 canines turned into wide and sharp incisors, pointing obliquely forwards; on the upper jaw, the frontal group is missing, its anterior part being covered by a keratic plate. Then there is an empty space known as bar (where the premolars should have been). The molars, three on each hemi-arcade, display half-moon enamel crests, sagittally oriented (figure 1).

Figure 1. *Bovine skull (from the collection of the Faculty of Veterinary Medicine, Laboratory of Compared Anatomy, Bucharest)*

In terms of the occlusion, our results are in

concordance with the literature [11-13], that the mandible-maxillary relations are distal, and the vestibular incline of the frontal group compensates the gap between the lower and upper alveolar process. Transversally, the maxillary dental arcade exceeds by more than a tooth the width of the mandibular dental arcade, allowing thus the movement of the mandible (figure 2). These findings support the suggestions of Baydas , Firu and Ferrario [6,10, 14] . According to several studies [15-17] , vertically, one can notice a highly accentuated curve of Spee (figure 3).

Figure 2. *The occlusions relations in the transversal plane in bovines (from the collection of the Faculty of Veterinary Medicine, Laboratory of Compared Anatomy, Bucharest)*

Figure 3. *Curve of Spee in bovines (from the collection of the Faculty of Veterinary Medicine, Laboratory of Compared Anatomy, Bucharest)*

In prehension, the animal selects food with the mandible teeth, food which it fixes on the upper arcade by means of the upper lip. In these conditions, with the mandible moving, the lateral areas are in desocclusion, the important curve of Spee having no role in the mandibular movement and the prehension of food. Probably, due to specialisation, the premolar and canine areas underwent changes, preventing any obstacles to the food “mowing” movement.

The mandibular condyle, through its fusiform and transversally orientated shape, allows the sway movement of the mandible.

To our knowledge, this is the first report evaluating and measuring the anatomical dental aspects who highly resemble in cows and sheep. Our results are in concordance with the literature [18,19].

The dental formula of rodents is represented by 2 central incisors, 2-4 lateral incisors (according to the race), no canines, 3 premolars and 3 molars. The molars present transversally orientated enamel crests (figure 4).

Figure 4. *Dental formula in rodents (from the collection of the Faculty of Veterinary Medicine, Laboratory of Compared Anatomy, Bucharest)*

The principal findings of this study are shown in figures 3 and 4. What are the clinical implications of our findings? Several studies [20,21] have analised the occlusal relantionships but our findings provide insight into the details: the occlusion reveals a neutral relation in the sagittal plane, with “end-to-end” incisor contact and a molar occlusion plane, posterior and superior inclined, but in a direct line, without any vertical gaps in the premolar - molar group. These results give orthodontists a guideline about the fact that

transversally, there is an increased dimension of the upper arcade which gives freedom to the mandible in the propulsion movements.

Furthermore, since our findings indicate that in the end-to-end frontal relation there is desocclusion of the lateral areas, we believe that this underscores the importance of the fact that the contact is being done strictly in the frontal area.

4. Conclusions

Investigating the anatomical aspects in the two types of mammals with exclusively transversal or sagittal mandibular movements, specialisations which appeared over long periods of time, along the phylogeny, several conclusions can be drawn as to the impact and opportunity of each anatomical sector in relation to the pattern of mandibular movement.

Thus, the curve of Spee is useful in laterality movements. The curve of Spee, along with the condylar pattern, blocks any type of mandibular movement in the sagittal plane.

Its existence in animals implies a freedom of the mandibular movement in the anterior area (absence of incisors-canines-premolars). The propulsion movement, accompanied by retro-propulsion (in rodents), implies total freedom in the median and posterior area, with a straight occlusion plane.

The rodents, with mandibular anterior-posterior movements, do not present any type of curve of Spee.

Analysing the recovery orthodontic techniques of the Angle 2nd class and regarding the phylogenetical argument, we can assume that the existence of the curve of Spee in children is a very important anatomical factor in the genesis of the 2nd class anomaly.

A reference from specialty literature which reinforces the above argument is the existence of the acquired unilaterally dominant mastication syndrome where, on the unilateral mastication side, the curve of Spee is stressed and the occlusion relation is distal.

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