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Abstract: The stomatognathic structures act as a complex and integrated system, thereby accomplishing several essential functions of the body. Aside from participating in food digestion, they are key for respiration and swallowing and play a central role in social interaction and stress management. The lifeworks of Robert M. Ricketts (1920–2003), an American orthodontist, and Rudolf Slavicek (1928–2022), an Austrian prosthodontist, were centered on this understanding. Both were educated in the time of gnathology, functional dentistry, and cephalometry and were ready to challenge conventional knowledge and traditions, leading toward innovation. As untiring clinicians, researchers, and mentors, they were fully invested in the study of the stomatognathic system, considering its morphology, dynamics, growth patterns, evolution, and interactions with the body and mind. Based on their extensive knowledge of the masticatory system, they advanced dentistry both with theoretical notions and by implementing new diagnostic and therapeutic concepts, thus reinforcing the idea of dentistry as a medical discipline requiring interdisciplinary effort. Their heritage is represented by numerous publications, discoveries, and inventions that inspire the dental community to follow their exemplary approach to the individualized care of patients. Their knowledge and passion are further passed on through their students. As part of their legacy, they prepared the ground for new research aimed at fostering advancements in occlusion medicine, hence supporting education in oral health.

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Special Article

Robert M. Ricketts and Rudolf Slavicek: dentistry by the rules of nature

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ABSTRACT

The stomatognathic structures act as a complex and integrated system, thereby accomplishing several essential functions of the body. Aside from participating in food digestion, they are key for respiration and swallowing and play a central role in social interaction and stress management. The lifeworks of Robert M. Ricketts (1920–2003), an American orthodontist, and Rudolf Slavicek (1928–2022), an Austrian prosthodontist, were centered on this understanding. Both were educated in the time of gnathology, functional dentistry, and cephalometry and were ready to challenge conventional knowledge and traditions, leading toward innovation. As untiring clinicians, researchers, and mentors, they were fully invested in the study of the stomatognathic system, considering its morphology, dynamics, growth patterns, evolution, and interactions with the body and mind. Based on their extensive knowledge of the masticatory system, they advanced dentistry both with theoretical notions and by implementing new diagnostic and therapeutic concepts, thus reinforcing the idea of dentistry as a medical discipline requiring interdisciplinary effort. Their heritage is represented by numerous publications, discoveries, and inventions that inspire the dental community to follow their exemplary approach to the individualized care of patients. Their knowledge and passion are further passed on through their students. As part of their legacy, they prepared the ground for new research aimed at fostering advancements in occlusion medicine, hence supporting education in oral health. (*Angle Orthod*. 2023;93:497–500.)

KEY WORDS: Ricketts; Slavicek; Occlusion medicine; Orthodontics; Stomatognathic system; Interdisciplinary work

RICKETTS AND SLAVICEK AS LIKE-MINDED DOCTORS

Robert Murray Ricketts (Indiana, 1920, to Arizona, 2003) and Rudolf Slavicek (Austria, 1928–2022) were like-minded, visionary doctors who recognized the importance of treating patients by the rules of nature. Ricketts was an ingenious orthodontist, and Slavicek was an inquisitive prosthodontist, and they shared numerous traits. Both recognized the complexity of the craniomandibular system and thus steered away from simple solutions in oral health care. They worked tirelessly for the understanding of human nature while focusing on the masticatory system and its pathology. They considered teeth as elements of an integrated set of anatomical structures forming the stomatognathic system, which adapts during growth and development while the individual's uniqueness is maintained. Always inclined toward innovation, they were ready to challenge conventional knowledge. Their acute awareness of craniomandibular function combined with their clinical experience and creativity led them to the development of new methods and

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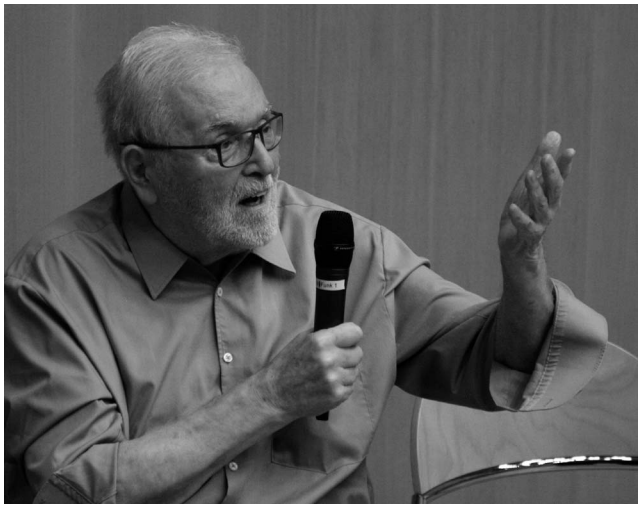

Figure 1. In this 2019 photo, Slavicek engaged in discussion in the Summer School, a yearly event by the Vienna School of Interdisciplinary Dentistry and the Medical University of Vienna.

guidelines for diagnosis and treatment. Both were lifelong learners and prolific researchers, but perhaps their greatest legacy was their impact as teachers and mentors. Thus, they continue to be a source of inspiration (Figure 1).

THE ERA OF GNATHOLOGY AND CEPHALOMETRY

Being born only a few years apart in the 1920s, Ricketts and Slavicek were influenced by Edward Angle (1855–1930), who advocated for a functional approach to the treatment of occlusion, and Beverly B. McCollum (1883–1968), one of the founders of the gnathological society. They were trained to look at the stomatognathic system rather than just the teeth, cognition that was reinforced by their own clinical experience and research findings. They were also born in the era of radiographs and landmark-based measurements. Ricketts brought into clinical practice the use of cephalometry for individualized assessment of the shape and proportions of the faces of patients. He established references for the evaluation of individual parameters and developed computer-assisted cephalometry with growth predictions to forecast adult facial shape. Similarly, Slavicek realized the importance of facial morphology early in his career and, starting from Ricketts' cephalometric analysis, introduced the concepts of "chewing efficiency" and "disocclusion angle."

OCCLUSION AND THE TEMPOROMANDIBULAR JOINT

Ricketts proposed causal explanations for temporomandibular joint degeneration and malocclusion leading to an unfavorable position of the mandible, including lack of posterior support, posterior interferences, and skeletal Class II.[1] He regarded retrusion of the anterior teeth after orthodontic extraction of premolars as potentially harmful to the joints, a viewpoint shared by Slavicek and confirmed by recent research.[2]

Slavicek had a similar awareness of the reciprocal influence of occlusion and the temporomandibular joints. He was a student of gnathology, a voracious reader, and a brilliant mind capable of synthesizing huge amounts of information into his teachable, practical concepts of occlusion.[3] His early appreciation for temporomandibular joint and mandibular dynamics furthered his use of hinge axis recorders for accurate three-dimensional instrumentation analysis and therapy.

ESTHETICS OR FUNCTION?

Aware of the importance of the structural, functional, and esthetic aspects of the stomatognathic system, both Ricketts and Slavicek regarded the diagnostic process as essential; thus, they were rigorous about documentation. Ricketts's well-informed interpretation of facial shape and proportions as per the "keystone triad,"[4] the "principle of arcial growth of the mandible,"[5] and the "divine proportions of the face"[6] ideas allowed him to advocate for esthetics as the primary treatment goal. Slavicek, instead, would endorse function as the guiding concept for treatment, convinced that esthetics would inevitably follow. This apparent contradiction is easily resolved in light of the discussion in *The Masticatory Organ*,[7] in which human appearance is explained as a function and does not have to be confused with cosmetics. For instance, Ricketts observed that skeletal Class II individuals showed an increased anteroposterior displacement of the mandible in opening and closing and postulated that they would be prone to muscle strain during speech. This is an example of Ricketts's clear understanding that a lack of esthetic proportion could alter functional requirements.

Slavicek also considered speech as one of the dominant functions of the stomatognathic system and considered the masticatory structures a key element for stress management; hence, he saw bruxism as a physiological activity. Later, he collaborated in research corroborating these assumptions[8] and concluded that the therapeutic goal was an occlusion withstanding bruxism-generated forces rather than elimination of bruxism.

Slavicek's focus on function reflected on his diagnostic protocol, which consisted of a clinical evaluation, including general anamnesis, intra- and extraoral muscle palpation, assessment or mandibular function, cranial nerve examination, and interpretation of occlusograms. In addition, he evaluated mandibular kinematics by means of condylography, introducing the concept of reference position, an individualized, yet highly reproducible, starting point for each mandibular movement.[9] In

Slavicek's diagnostic protocol, the superimposition of cephalometric analysis and condylographic tracings[10] is relevant for integrated interpretation of the morphology and dynamics of the patient's masticatory system.

MAIN ACHIEVEMENTS

Ricketts is best known for his advancements in the use of cephalometry and the bioprogressive model for diagnosis and orthodontic treatment,[11] a set of methods and techniques stemming from interdisciplinary work accounting for bone physiology and rules for facial proportions and dental arrangement. Slavicek, as well, was concerned with both the general function of the stomatognathic system and the functional nuances of teeth. Thus, he founded the interdisciplinary Division for Temporomandibular Disorders, University Dental Clinic Vienna, Austria, and developed guidelines for a stable and functional bite, giving adequate support to the temporomandibular joints and allowing strain- and pain-free neuromuscular activity.

Building on the balanced occlusion concept of McCollum, Slavicek modified the wax-up technique from posterior to anterior teeth, gradually increasing inclination of the laterotrusive pathways of the buccal cusps, thus creating sequential disocclusion or "sequential guidance."[8] His occlusion concept accounts for factors such as the morphology of the teeth and the shape and relative position of the dental arches in relation to the face.

A BROAD VIEW ON THE STOMATOGNATHIC SYSTEM

Ricketts and Slavicek crossed paths when Ricketts visited the capital of Austria in the 1990s (Figure 2) and, together with Slavicek, observed the skeletal collections housed at the Natural History Museum Vienna and their differences in craniofacial and occlusal morphology in comparison with contemporary humans.[12] This led Ricketts to a deeper realization about the characteristics of natural occlusion and the detrimental effects on the temporomandibular joints and periodontal tissues of missing teeth and malocclusion. Slavicek, like Ricketts, interpreted the current human condition as the result of adaptive processes in response to the changing environment. Similarly, both were careful observers of the changes occurring during growth and development and further elaborated on the dental, skeletal, and articular compensations occurring to buffer dental and skeletal deformities, thus maintaining the importance of early treatment.[4,13]

ADVANCEMENT OF MODERN DENTISTRY

Ricketts and Slavicek unraveled numerous key aspects of the geometry and dynamics of occlusion.

Figure 2. Ricketts studying the osteological collections of the Natural History Museum Vienna during his visit to the Austrian capital in September 1997.

Thanks to their deep understanding of the stomatognathic system and its mutual influence on the human body and psyche, they could develop concepts and guidelines for the diagnosis and treatment of occlusion. To refer to his field of work, Slavicek used the definition "occlusion medicine,"[8] thereby emphasizing the fact that dentistry, as a medical discipline, should account for the complexity of the human organism when treating occlusion. In turn, occlusion should be considered in a broad sense as the active, dynamic, and sensorial part of the stomatognathic system that serves as an interface between the environment and the organism (including its digestive, respiratory, and nervous systems and postural control) allowing an exchange of food, air, sensorial, and social stimuli.

The authors of this article acknowledge the work of Ricketts and Slavicek and aim to build on their heritage through research focusing on theoretical, clinical, and technical aspects of oral health, with the purpose of supporting education and fostering advancement in occlusion medicine.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

REFERENCES

1. Ricketts RM. Abnormal function of the temporomandibular joint. *Am J Orthod*. 1954;41:435–441. doi:https://doi.org/10.1016/0002-9416(55)90154-8
2. Londoño A, Assis M, Fornai C, Greven M. Premolar extraction affects mandibular kinematics. *Eur J Dent.*

Epub ahead of print September 27, 2022. doi:10.1055/s-0042-1755629
3. Slavicek R. Principles of occlusion [Prinzipien der Okklusion]. *Inf Orthod Kieferorthop*. 1982;14:171–212.
4. Ricketts RM. The keystone triad: I. Anatomy, phylogenetics, and clinical references. *Am J Orthod*. 1964;50:244–264. doi: https://doi.org/10.1016/S0002-9416(64)80003-8
5. Ricketts RM. A principle of arcial growth of the mandible. *Angle Orthod*. 1972;42:368–386. doi:10.1043/0003-3219(1972)042<0368:Apoago>2.0.Co;2
6. Ricketts RM. Divine proportion in facial esthetics. *Clin Plast Surg*. 1982;9:401–422. doi:https://doi.org/10.1016/S0094-1298(20)31936-2
7. Slavicek R. *The Masticatory Organ: Functions and Dysfunctions*. Klosterneuburg, Austria: Gamma Medizinisch-Wissenschaftliche Fortbildungs-GmbH; 2002.
8. Sato S, Yuyama N, Tamaki K, et al. The masticatory organ, brain function, stress-release, and a proposal to add a new category to the taxonomy of the healing arts: occlusion medicine. *Bulletin of Kanagawa Dental College*. 2002;30:117–126.
9. Fornai C, Tester I, Parlett K, Basili C, Costa HN. Centric relation: a matter of form and substance. *J Oral Rehabil*. 2022;49:687–690. doi:https://doi.org/10.1111/joor.13329
10. Slavicek R. Clinical and instrumental functional analysis for diagnosis and treatment planning. Part 6. Computer-aided diagnosis and treatment planning system. *J Clin Orthod*. 1988;22:718–729.
11. Ricketts RM. Bioprogressive therapy as an answer to orthodontic needs. Part I. *Am J Orthod*. 1976;70:241–268. doi:10.1016/0002-9416(76)90332-8
12. Ricketts RM, Teschler M, Slavicek R. Skulls of the past still speak (The Vienna Project 1997). *Stomatologie*. 2004;8:173–186.
13. Slavicek R. Dr. Rudolf Slavicek on clinical and instrumental functional analysis for diagnosis and treatment planning. Part 1. Interview by Dr. Eugene L. Gottlieb. *J Clin Orthod*. 1988;22:358–370.