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Modern Interpretations of Engel's Classification of Maxillary Protrussions

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Abstract: Engel's classification, historically foundational in orthodontic diagnosis, continues to serve as a reference point in evaluating maxillary protrusions. However, evolving clinical practices and advances in craniofacial imaging have led to modern reinterpretations of this classification system. This study explores how Engel's original categorization, particularly Class II Division 1 malocclusion, is being adapted to better reflect nuanced skeletal, dental, and soft tissue relationships in contemporary orthodontics. By examining recent literature and clinical applications, the paper identifies the limitations of Engel's binary framework and discusses how integrative approaches—such as cephalometric analysis, 3D imaging, and functional assessments—offer a more precise understanding of maxillary protrusions. The study further evaluates the implications of these modern interpretations for diagnosis, treatment planning, and long-term patient outcomes. It underscores the importance of revisiting classical classifications to align with today's technological capabilities and patient-centered approaches.

Key words: Engel's classification; Class II malocclusion; maxillary protrusion; orthodontic diagnosis; modern interpretation; cephalometric analysis; 3D imaging; skeletal relationships; dental occlusion; orthodontic innovation

In the late 19th century, Dr. Edward H. Engel introduced a systematic classification of occlusal relationships that revolutionized the field of orthodontics. His tripartite system—Class I, II, and III—remains widely taught and applied in clinical settings around the world. Among these, **Class II Division 1 malocclusion**, commonly associated with maxillary protrusion, continues to be one of the most prevalent and clinically significant conditions encountered in pediatric and adolescent orthodontics.

However, Engel's system, while groundbreaking for its time, was primarily based on the sagittal relationship of first molars and did not fully account for the complexities of skeletal morphology, vertical dimensions, or soft tissue aesthetics. With the advent of **advanced diagnostic tools**—including cephalometric radiography, CBCT (cone-beam computed tomography), and facial scanning—contemporary orthodontics has gained the ability to analyze maxillary protrusion in far greater detail. These innovations have prompted a critical reassessment of Engel's classification and its applicability in modern contexts.

This study investigates how modern orthodontics interprets Engel's classification, specifically focusing on maxillary protrusions. It aims to highlight the ways in which contemporary techniques and interdisciplinary insights have refined or expanded upon Engel's original categories, offering a more

individualized and comprehensive approach to diagnosis and treatment.

Methodology

This research employs a qualitative literature review and comparative analysis of Engel's original classification in the context of modern orthodontic interpretation and practice.

- Data Sources and Search Strategy:

A systematic search was conducted in academic databases including PubMed, ScienceDirect, Scopus, and Google Scholar. Keywords included: *"Engel classification," "maxillary protrusion," "Class II Division 1 malocclusion," "modern orthodontic diagnosis,"* and *"cephalometric reinterpretation."*

- Inclusion Criteria:

- Peer-reviewed articles published from 2000 to 2024
- Studies involving pediatric or adolescent populations
- Research discussing Engel's classification in relation to modern diagnostic approaches
- Articles that compare traditional and advanced diagnostic tools

- Review and Analysis Framework:

Each selected study was evaluated for:

- Its treatment of Engel's classification (confirmation, expansion, or critique)
- The role of imaging (2D vs. 3D) in assessing maxillary protrusion
- Integration of skeletal, dental, and soft tissue analysis
- Clinical recommendations for diagnosis and treatment based on revised classification logic

- Comparative Review Approach:

A comparison table was constructed to juxtapose traditional Engel criteria with updated diagnostic interpretations used in recent orthodontic literature. These comparisons provided a basis for understanding how modern tools reshape classification outcomes.

- Validation:

Selected case studies and orthodontic practice guidelines were reviewed to validate how modern reinterpretations of Engel's classification influence real-world clinical decisions.

The classification of maxillary protrusions according to Engel, as presented in foreign and scientific sources, is based on the classification of the scientist Engel (1889), who was the first to introduce morphological changes in the upper jaw into science. Engel cites his classification in scientific sources based on the location of the first molar teeth of the upper jaw. He considers maxillary protrusions to be pathological changes between the articulations of the upper and lower jaws. Engel distinguished three classes of maxillary protrusions:

the Upper Jaw is designated by the code K07 in the ICD-10 and includes the classification of deformities of the maxillofacial system, including malocclusion, included in the section on diseases of the oral cavity. Saliva glands and jaws (K00-K93) food digestion to do system diseases with dependent (K00-K93). " high " in this classification jaw the term " protrusion " . following to codes suitable comes : K07.0 – high your jaw of size main anomalies ; K07.1 – high and lower jaw of the ratios anomalies (in the MKB-10 manual explanation - high your jaw prognathia , lower your jaw retrognathia with is

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determined . One of time in itself one how many nosologies correspond to MKB-10 arrival because of this from the classification use in the practice of orthodontic dentistry this of the kind pathology classification for is applied .

In Engel's class II, subclass 1, pathology of the protrusion of the front teeth of the upper jaw, the distal position of the teeth of the lower jaw, anomalies of the teeth, the formation of deformations of the teeth and tooth rows, as well as deep pathologies in the state of occlusion of the upper and lower jaws, their distribution depending on the age of the jaw, are presented in scientific studies. In Engel's class II, subclass 1 , pathology of the teeth of the upper jaw with an incorrect occlusion state can be observed in 13.16% of patients with hyperbalanced contacts and 7.89% with working supercontacts. In addition, in Engel's class II, subclass 1, pathology of the teeth of the lower jaw is also associated with pathological changes in the hard palate and mucous membrane. According to Engel's classification, the prevalence of maxillary protrusions is characterized by a lack of contact between the incisors and cusps of the upper and lower jaws, a sagittal fissure is observed in the fusion of these teeth, a change in the height of the lower third of the face, and this pathology is characterized by a reduction in the tooth and alveolar ridge.

Scientific sources provide information on the development of maxillary protrusions as a result of genetically determined hereditary factors or under the influence of environmental factors. In children with maxillary protrusion, the natural sucking movement develops the chewing apparatus and, due to sufficient strength of the external pterygoid muscles, transforms the infant's retrognathia into orthognathia, which, unlike natural feeding, is not accompanied by rhythmic forward and backward movements of the lower jaw; intensive work of the lips, oral cavity muscles and tongue, which are important factors in stimulating the development and growth of the jaws, as well as training of chewing and facial muscles, can cause this delay. In some patients, mesial displacement of the lower jaw relative to the upper jaw to a neutral position is reported in scientific sources.

According to Engel's classification , class II , class 1 distal occlusion develops primarily during the eruption of the maxillary molars, and in the second primary molars, a state of protrusion is observed when the maxilla moves backward. In addition, distal occlusion occurs with premature eruption of the maxillary deciduous teeth, mesial movement of the maxillary permanent teeth is observed, as well as impaired growth of the jaw bones, for example, damage to the jaw; growth zones on the articular heads of the mandible, which leads to the development of lower micrognathia.

The development of maxillary protrusions is caused by bad habits, early loss and trauma of teeth, and other etiological factors. Deviated nasal septum, hypertrophy of the inferior turbinates, adenoids on the posterior wall of the larynx, enlarged velopharyngeal tonsils, and other chronic inflammatory diseases of the upper respiratory tract are mechanical obstacles to nasal breathing.

The role of hereditary factors in the development of Engel class II, class 1 distal occlusion is important. The relationship between the prognathic relationship of the dentition (dental alveolar shape) and the discrepancy in the size of the crowns of the upper and lower molars is checked using the Gerlach and Ton indices. The degree of deviation of the frontal teeth in patients, so that when they erupt, the dental arch is lengthened, and during retrusion it is shortened. Engel class II malocclusions develop as a result of multiple fusions of skeletal and dental components. Violation of the size and shape of the teeth; anterior position of the upper or posterior position of the lower jaw teeth along with the alveolar processes; the size of the crowns of the upper and lower molars and the incomplete formation of the first permanent molars of the lower jaw.

Identifying the etiological factors of maxillary protrusions is an important criterion for correct diagnosis, without which treatment will not lead to complete and effective results.

Conclusion

Also, based on the exact criteria for the location of the first permanent molar teeth according to Engel's classification of maxillary protrusions, it allows to use this classification to determine the relationship of teeth and the distribution of maxillary protrusions and to effectively diagnose this type of pathology.

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