

## REVIEW ARTICLE

**ARTICULATOR APPLICATION IN ORTHODONTIC DIAGNOSTICS**

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**ABSTRACT****The aim:** The purpose of the study was to determine the indications for the use of articulator in orthodontics based on the results of the analysis of scientific and foreign literature.**Materials and methods:** 23 scientific sources were selected, from more than 11 countries over the past 39 years (1981 – 2020) devoted to the use of orthodontics articulators. As a result of processing 23 key international scientific papers on the use of articulators in orthodontics, we can talk about three areas of opinion regarding this problem.**Conclusions:** To sum up 30.34% of authors consider the articulator to be an obligatory orthodontist's tool for correct diagnosis. The idea of 34.78% of specialists is that the articulator cannot simulate the physiology of the TMJ – therefore, it is more a source of additional errors than an assistant in the orthodontic diagnostics. The rest of the scientists (34.78%) agree that it is advisable to use the articulator selectively – namely, if the doctor deals with “complex” orthodontic pathologies.**KEY WORDS:** dental articulators, dental occlusions, temporomandibular joint

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**INTRODUCTION**

The masticatory organ is a complex system of structural and functional interrelations. Unfortunately, doctors often neglect its thorough functional diagnostics. With the rapid development of dental technologies and unlimited possibilities for a treatment method choice orthodontist faces the problem of functional diagnostics as an integral part of modern orthodontics as never before [1].

One of the reasons for this situation is probably the lack of consensus regarding diagnostic methods. The divergence of opinions causes a feeling of uncertainty and even anxiety among practicing orthodontists before using systematic functional diagnostics in their daily practice. Without competent functional diagnostics, orthodontic treatment will be unpredictable, which leads to an increase in the number of patients with various complications [2].

The search for the causes of functional disorders requires the introduction of systematic methods that must be adapted to each specific clinical situation.

The purpose of examination procedures is diagnosis while the purpose of diagnosis is a flawless treatment plan. More information we have about the patient – more competent the diagnosis and more predictable the treatment will be. The final treatment plan is drawn up after a functional, structural and aesthetic analysis of the patient's oral cavity, X-ray examination, investigation of plaster models of the jaws, which are subsequently cast in an articulator along the facial arch.

When it comes to a complex and lasting orthodontic treatment, patients have a number of fears. One of them is the fear of undesirable and unpredictable functional changes. This anxiety is not in vain as improperly per-

formed treatment not only causes discomfort and impaired masticatory function, but also more serious problems as persistent headaches, TMJ dysfunction, musculoskeletal diseases in the skull and cervical spine area, etc. To minimize the risk of such unpleasant consequences, it is necessary to consider not only the peculiarities of the mutual arrangement of the jaws, but also the trajectory of movement of the mandible, which is a very individual indicator. This is where the articulator comes in.

**ARTICULATOR IMPLEMENTATION HISTORY**

In 1858 while examining a skull Bonneville found that the average distance between the condylar processes and the incisal point is 10 cm. By connecting these points, a triangle is obtained which is called Bonneville's triangle. It serves as one of the basic building blocks of many anatomical articulators to determine the spatial position of models in the articulator [3].

One of the first gnathological societies was founded by the German doctor B. McCollum back in 1926. Together with Harlan, they developed the first effective method for localizing the transverse (transversal) horizontal axis and transferring the registration impression into the articulator using the Snow facial arch. McCollum and Stewart published a research community in which they formulated the principles of mandibular movements in the transversal and horizontal axes, the ratio of the maxilla to the mandible in an articulator that was designed to reproduce the movements of the dentition. Before the emergence of new modern articulators, many stages of their improvement passed [4, 5]. The purpose of articulator usage is to ac-



**Fig. 1.** Simple hinge articulator

curately simulate the relationship of the upper and lower jaw, including the registration of the parameters of the occlusal surfaces with further reproduction of the boundary movements of the mandible. The new development of functional diagnostics is associated with the name of the Swiss physician Alfred Gizi. He suggested that the problem of articulation could be solved by recording the individual movements of the mandible and reproducing them technically. According to Gizi, it is the TMJ that directs the movements of the mandible. He created an articulator which consisted of elements that repeated the anatomy of a human joint. Earlier, Dr. Gizi began using the articulator to model the occlusal surfaces of artificial teeth. [6]

In 20th century dentistry, the concept of balanced occlusion prevailed. However, Stewart denied the validity of this concept. Uneven erasure of the buccal and lingual cusps of teeth with the formation of deflecting occlusal contacts leads to a change in the nature of jaws closing according to his opinion. These patients complain of frequent biting on cheeks and tongue, which indicates a loss of masticatory efficiency. It is the articulator (from the Latin articulus – joint, articulation) that makes it possible on the patient's working model to reproduce the movements characteristic of the mandible, to study the mutual arrangement of the jaws during mastication, the amplitude of mouth opening and closing, protrusive, retrusive and lateral movements of the mandible.

Back in 2002, Rudolf Slavichok spoke about the rationality of using articulators in the diagnosis and choice of a treatment strategy for pathological types of occlusion; planning complex types of dental treatment; manufacturing of various orthodontic structures; the manufacture of dentures of any complexity (removable and fixed); diagnostic grinding of teeth; when planning orthognathic operations; [1, 7]. And this is far from all the manipulations

in which modern dentists cannot do without an articulator.

Orthodontists constantly ask the question if they really need an articulator and a facial bow in their daily orthodontic appointments. Is it always needed to mount models to the articulator? Therefore, the issue of use is not a definite “yes” or “no”, but a matter of rational use.

Before searching for an answer to the question posed, the awareness about the articulators types is needed.

#### TYPES OF ARTICULATORS

There are five main types of articulators: simple hinge articulators; Mean value or fixed condylar path articulators; semi-adjustable; fully-adjustable or versatile; virtual articulators.

In a simple hinge articulator (Fig. 1), only hinge movements are possible, any lateral movements are excluded. The opening / closing path of the articulator frame does not match the opening / closing path of the mouth. Articulated articulators only reproduce the pathology of the bite, and do not help to eliminate it.

In mean value articulators (Fig. 2), the value of the condylar and incisal angle is fixed. You can change the relationship of the incisors, but there is no way to adjust lateral shift. Benet's angle is fixed – 15° and horizontal condylar path – 35°.

Mean-value articulators can be used for the manufacture of single crowns and, if necessary, for the manufacture of a complete removable denture with edentulous jaws [8].

Semi-adjustable articulators (Fig.3) have mechanisms for reproducing the condylar and incisal paths, which are regulated both according to the average data and according to the individual angles of these paths. Their significant advantage is the ability to adjust the angle of the sagittal condylar path. This type of articulator is convenient for use in most clinical cases [9].

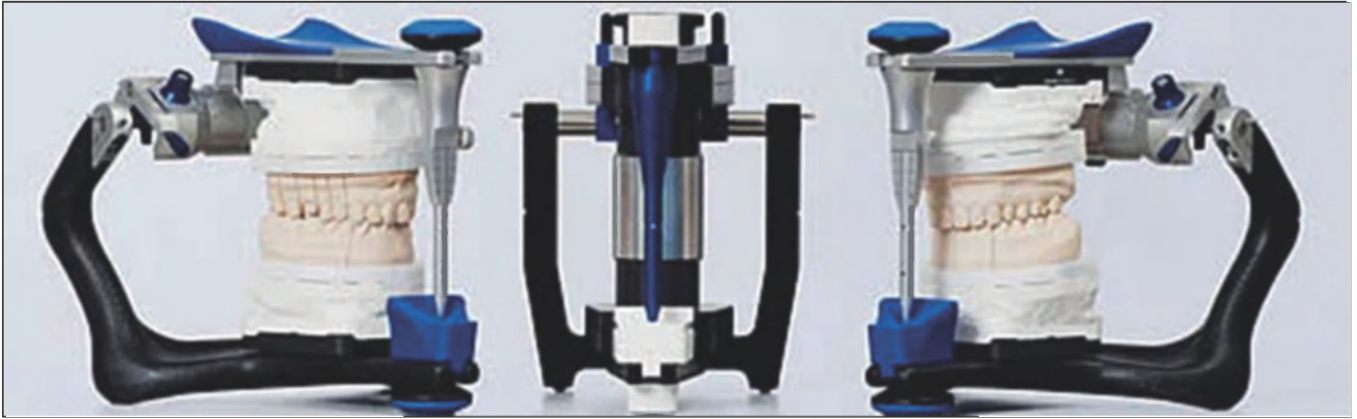
There are two types of semi-adjustable articulators:

ARCON (arc) – the condylar ball is located below the guiding surfaces, its movements depend on the relief of the occlusal surface of the teeth (“sliding” articulator). It models the condylar process. The system is made in the form of a movable ball moving along the hole. This type is used in multi-purpose facial arch articulators.

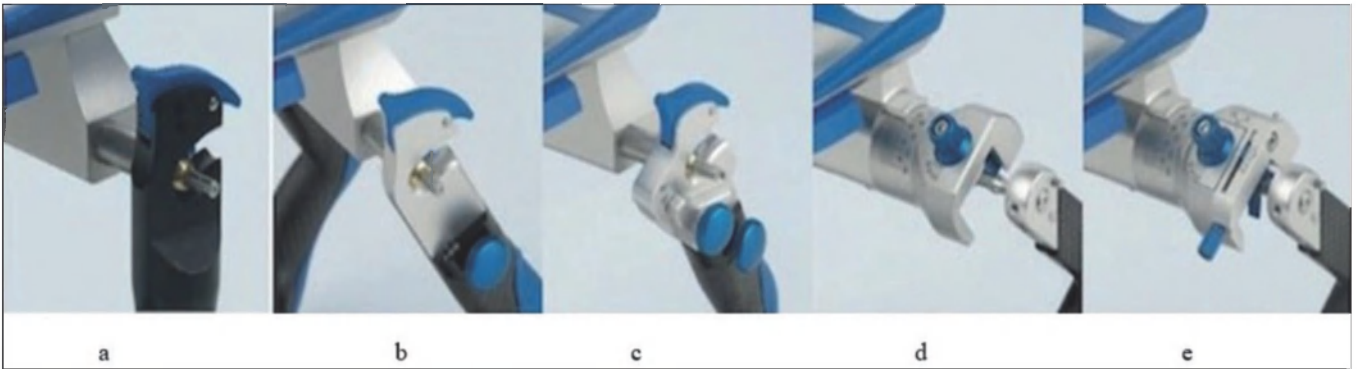
Non-ARCON (arcless) – the condylar ball is located in a rut, which limits its movement within certain limits, the movements of the mandible depend on the established angles (“condylar” articulator). An immediate simulator, which repeats all the movements of the joint, is located at the top of the mechanism.

Each variant has its own advantages and disadvantages. The first option (arcon) is most often used. It is more in line with the human anatomy, it is quite easy to customize and has replaceable elements. All this makes the work on the arcon system convenient and accurate enough. The only drawback of this system, which is inherent in old articulator models, is the need for constant pressure on the upper frame.

The Non-arcon system allows you to work with securely fixed models. However, it does not provide for a change in the shape of the heads, there are inaccuracies from an ana-



**Fig. 2.** Mean Value or Fixed Condylar Path Articulators



**Fig. 3.** Semi-adjustable articulators «Non-arcon» (a, b, c) and «Arcon» (d, e)



**Fig. 4.** Fully-adjustable or universal articulator

tomical point of view. Therefore, usually all the necessary measurements are made using the Arcon articulator, which in this respect is more accurate and more convenient, and then the results are transferred to a more reliable in terms of data fixation – Non-Acorn [10]

Fully adjustable or universal articulators (Fig.4) adjust the angles of the lateral condylar path and horizontal con-

dylar path as well as the lateral shift. This device reproduces the movements of the mandible with the greatest accuracy and is used to draw up a treatment plan for complex orthodontic pathologies and in the manufacture of the most complex prosthetic constructions that require careful occlusal analysis. This type of articulator is adjusted according to the individual data of the position of the jaws using the facial bow. In universal articulators, it is also possible to adjust protrusion up to 6mm and retrusion up to 2mm [11].

Digital (virtual) articulator (Fig.5) – In modern programs for modeling dentures there is a place reserved for the function of a virtual articulator. Complex and relatively expensive mechanical systems can be eliminated. They are being replaced by computer systems. The function of the virtual articulator is implemented in such a way that the models of the jaws are scanned using a 3D scanner and placed in the 3D space of the dental scanner in the position they occupy relative to the articulator frames [12]. To work in virtual space, taking into account the individual parameters of the patient, it is necessary to have computed tomography (CBCT), virtual models, trajectories of movement and the correct orientation of virtual models of both jaws [13].

CAD – Computer-Aided Design is a software that allows to identify the spatial position of the virtual dentition relative to the hinge axis. Then, the program uses the averaged characteristics or sets the individual characteristics of the angles of movement of the mandible, predetermined in advance with axiography [14,15].



Fig. 5. CAD software or virtual articulator concept

Correct mount of the model into the articulator will not be possible without the preliminary mount of the facial arch to the patient. The data gained with the facial arch is transferred to the articulator. The arc is not used in all cases, but its application allows to get more accurate individual indicators. For the most accurate reproduction of the parameters of the position of the maxilla relative to the mandible hinge rotation axis it is necessary to perform the following manipulations in the articulator:

- to obtain an occlusal impression (wax plate, silicone);
- to fix the face bow;
- to mount models into the articulator.

### THE AIM

The aim of the study was to determine the indications for the articulator usage in orthodontics based on the results of the analysis of scientific literature.

The study involved 37 scientific sources over the past 39 years (1981 – 2020).

### MATERIALS AND METHODS

We have selected 23 scientific (Table I) sources from more than 11 countries of the world (South Korea, Japan, USA, Australia, Czech Republic, Italy, Spain, Austria, PRC, Germany, UK, etc.) over the past 39 years (1981 – 2020) dedicated to the application of orthodontics articulators. The remaining 14 publications allowed us to present a historical picture of the appearance of the articulator in dentistry in general, its technical improvement over time and the expansion of indications for use, but were not included in the number of analyzed ones.

### REVIEW AND DISCUSSION

Having reviewed the scientific publications, it should be noted that there is no unequivocal opinion of scientists.

Regardless of time and geographic location, scientific researchers splitted into three main groups, namely, for the use of the articulator, against, and those who are for selective usage (depending on the pathology). Almost a third of researchers 30.34% (7 out of 23) were included in the “For” group, i.e. recommend to use of an articulator in orthodontics.

Theodore D. Freeland (2012) emphasizes that the articulator is an integral part of the orthodontic practice. According to him, it is possible to reveal hidden occlusal problems, especially in cases when it comes to the vertical position of the jaws only with the help of an articulator [33].

Domingo Martin and Renato Cocconi (2012) insist on the importance of using an articulator in clinical practice in order to improve the productivity of the orthodontist in complex multidisciplinary cases. The authors provide a list of significant reasons for mounting models into the articulator: assistance in determining the centrally oriented occlusion mismatch in 3 planes, assistance in determining the first point of contact in the central relationship, assistance in studying the patterns of abrasion and inclination of the maxillary incisors in patients with periodontal disease, assistance in determining the need for “trial” treatment, in drawing up plans for orthognathic surgery patients, assistance in the manufacture of joint splints [32]. The next group of researchers, voting for the “selective usage of articulators,” that is, according to direct indications. This group is 34.78% (8 out of 23), in other words, 3.44% more than the “For” group, which was 34.78%.

American orthodontics represented by D. Rinchuse, S. Kandasamy and co-authors in a series of articles [26-29,31] devoted to the problem of using articulators, explain their position that articulators are important when planning complex measures of

**Table I.** Publications on the use of articulators in orthodontics

Nº	Author	Article title	Year	Country	Position
1	Roth RH	Functional occlusion for the orthodontist. [16]	1981	Germany	Selective (depending on pathology)
2	Rinchuse DJ	The impact of the American Dental Association's guidelines for the examination, diagnosis, and management of temporomandibular disorders on orthodontic practice. [17]	1983	Czech	Against
3	Mohl ND	Temporomandibular disorders: role of occlusion, TMJ imaging and electronic devices—a diagnostic update. [18]	1991	USA	Against
4	Lindauer SJ, Isaacson RJ, Davidovich M.	Condylar movement and mandibular rotation during jaw opening. [19]	1995	USA	Against
5	Frank E. Cordray	Centric relation treatment and articulator mountings in orthodontics. [20]	1996	USA	Position for
6	J. R. Clark	Functional Occlusion: II. The Role of Articulators in Orthodontics. [21]	2001	United Kingdom	Against
7	Alpern MC, Alpern AH.	Innovation in dentistry: the polycentric occlusal system. [22]	2003	Czech/ USA	Selective (depending on pathology)
8	Alex Jacobson	Does articulating study casts make a difference to treatment planning? [23]	2003	United Kingdom	Against
9	C.Gartner/ B.Korda	The Virtual Articulator: Development and Evaluation. [13]	2003	Germany	Position for
10	Robert Kelleher	Common sense, open mind needed. [24]	2006	USA	Against
11	Richard M.Port	Articulators and gnathology: better care is the real goal. [25]	2006	USA	Selective (depending on pathology)
12	Donald J.Rinchuse Sanjivan Kandasamy	Articulators in orthodontics: An evidence-based perspective. [26]	2006	USA/ Australia	Selective (depending on pathology)
13	Donald J.Rinchusea Sanjivan Kandasamy	Word of mouth—articulators in orthodontics: chewing the facts. Part 1. [27]	2007	USA/ Australia	Against
14	Donald J.Rinchusea Sanjivan Kandasamy	Word of mouth—articulators in orthodontics: chewing the facts. Part 2. [28]	2007	USA/ Australia	Against
15	Donald J.Rinchusea Sanjivan Kandasamy	Myths of orthodontic gnathology. [29]	2009	USA/ Australia	Selective (depending on pathology)
16	J. Michael Hudson	Articulators in orthodontics. [30]	2012	USA	Position for
17	Donald J.Rinchusea Sanjivan Kandasamy	Articulators in orthodontics. [31]	2012	USA/ Australia	Selective (depending on pathology)
18	Domingo Martin. Renato Cocconi	Orthodontic dental casts: The case for routine articulator mounting. [32]	2012	Spain/ Italy	Position for
19	Theodore D. Freeland	Articulators in Orthodontics. [33]	2012	USA	Position for
20	Claudia Aichinger	Orthodontic dental casts: The case against routine articulator mounting. [34]	2012	Austria	Position for
21	Wang Li; Han Xianglong; Bai Ding	The controversy of routine articulator mounting in orthodontics. [35]	2013	China	Selective (depending on pathology)
22	1.Kaoru Inami 2.Yuri Higashi 3.KuoChiang	Prediction of dentofacial changes induced by an articulator intended for orthognathic surgery. [36]	2019	Japan	Selective (depending on pathology)
23	1.Park JH 2.Lee GH 3.Moon DN 4.Kim JC 5.Park M 6.Lee KM	A digital approach to the evaluation of mandibular position by using a virtual articulator. [37]	2020	Korea	Position for

orthodontic treatment with orthognathic surgery for establishing the correct vertical ratio at the laboratory stage of treatment. The authors also include here orthodontic cases with multiple tooth edentulousness, in which it is impossible to fix stable occlusal contacts, when there is a significant discrepancy (> 2 mm) between the fissure-cusp ratio. The authors recommend mounting of models in the articulator in persons with TMJ dysfunction.

This group includes the publications of researchers [12, 14, 15] who use a digital diagnostic protocol in their practice, based on the individual parameters of the patient, 3D scanning of the jaws, CAD programs, computed tomography, axiography. This method allows to compare these diagnostic data in a virtual space – in a virtual articulator. This program, as a more reliable method, allows you to identify the spatial position of the dentition relative to the hinge axis, eliminates the human error factor as in an analog articulator. In 2003, in Germany, C. Gärtner, B. Kordass [13] presented the results of comparative characteristics of two types of articulators: mechanical and virtual. In their opinion, the virtual articulator is not only a valuable addition to functional and occlusal analysis, but can also be used as a tool for planning and modeling complex orthodontic cases.

In general, both groups, ideologically close in spirit which are “For” and “For the selective usage of the articulator,” make up the overwhelming majority – 65.12%, i.e. in 15 articles out of 23 a scientifically substantiated point of view was expressed for the need for an adequate clinically justified use of an articulator, as another way to improve functional orthodontic diagnostics, which positively affects the correctness of treatment, quality and effectiveness.

The third orthodontic group “Against” are the opponents of articulators application in orthodontics, which is 34.78% (8 out of 23). One of the representatives of this position R. Kelleher [24] in 2006 made a conclusion in his article about the importance of adhering to sound principles of functional stability of occlusion. However, the idea that we can control the health of the temporomandibular joint using rigid measurements, manipulations and equipment, in his opinion, distracts from the real task of comprehending and collecting a unique anamnesis, conditions and response of each patient to treatment. Therefore, we must not rely on the devices which application may cause mistakes.

Thus, based on the data obtained as a result of processing 23 key international scientific publications devoted to the advisability of using articulators in orthodontics, we can talk about three areas of opinion regarding this problem. Supporters of the first opinion “For” claim about the expediency and mandatory use of articulators in the treatment of orthodontic pathology, motivating this with high diagnostic accuracy, physiology (considering the masticatory component) and improving the productivity of the orthodontist in multidisciplinary and complex cases [20, 13, 30, 32–34].

In this group of publications special attention should be paid to studies devoted to digital articulators – a modern method of digital diagnostics in orthodontics. Its application in combination with 3D imaging obtained with CBCT, as well as a digital scan of the oral cavity, is especially valuable, since it allows you to determine with maximum accuracy the physiological position of the patient's jaws relative to the base of his skull [13–15, 37].

However, there are also many scientists who support the opinion that articulator application in the treatment of orthodontic

pathologies is not advisable, motivating their point of view by the unreasonable expenditure of time and money, risk of making mistakes at various stages of working with the device, which can have an accumulation effect and ultimately negatively influence the result of treatment. The articulator, in their opinion, cannot accurately simulate the physiology of TMJ movements and the trajectory of movements of the mandible [17–19, 21, 23, 24, 27, 28].

The most logical, according to the results obtained, is the opinion of the second group of authors, who consider selective usage of articulators only in certain cases, in particular, when planning orthognathic surgeries in cases with multiple adentia, with TMJ dysfunction. In “simple” cases, the articulator may not be used to eliminate the risk of possible errors at various stages of its usage [16, 22, 25, 26, 29, 31, 35, 36].

## CONCLUSIONS

Thus, after analyzing all above-mentioned publications devoted to the usage of articulators for diagnosis of orthodontic pathology, we may conclude that scientists from the USA were most involved in this issue. To summarize, 30.34% of authors consider the articulator to be an obligatory tool of an orthodontist for correct diagnosis. The idea of 34.78% of specialists is that the articulator cannot simulate the physiology of the TMJ, therefore, it is more likely a source of additional errors than an assistant. The rest of the scientists (34.78%) agree that it is advisable to use the articulator selectively, namely, if the doctor deals with “complex” orthodontic pathologies.

Two groups, “For” and “for selective use of articulators” make up the overwhelming majority – 65.12%, they support the necessity of mounting models in the articulator. We can conclude that the usage of this diagnostic method definitely has its pros and cons, but in current realities, it is a modern and improved diagnostic method that has not lost its relevance for the past 39 years.

## REFERENCES

1. Zhang Z.K. Core position of occlusion, gnathology and related diagnosis and treatment principles that must be followed in stomatology. 2021;56(8):729-733. doi: 10.3760/cma.j.cn112144-20210709-00321..
2. Tanna N.K., AlMuzaini A.A.A.Y., Mupparapu M. Imaging in Orthodontics. Dent Clin North Am. 2021;65(3):623-641. doi: 10.1016/j.cden.2021.02.008.
3. Boulos P.J. Reproducibility of wax interocclusal records on different articulators. J Dent Res. 2018;29(6):755-759. doi: 10.4103/ijdr.IJDR\_695\_16.
4. Engelmeier R.L., Belles D.M., Starcke E.N. The History of Articulators: The Contributions of Rudolph L. Hanau and His Company—Part II. J Prosthodont. 2017;26(8):688-695. doi: 10.1111/jopr.12448.
5. Groß D., Groß K., Nitschke I. Alfred Gysi (1865-1957) – More than a Pioneer of Dental Prosthetics and Articulation. Swiss Dent J. 2020;131(2).
6. Engelmeier R.L., Belles D.M., Starcke E.N. The History of Articulators: The Contributions of Rudolph L. Hanau and His Company—Part II, Journal of prosthodontics. Implant, Esthetic, and Reconstructive Dentistry. 2016, 72p.
7. Semenova O.S., Kosykh B.A., Olshanskaya T.A. Features of working with an adjustable articulator in the manufacture of prosthetic structures of prostheses Bulletin of Medical Internet Conferences. 2018;8.

8. Bauer A., Gutowski A. *Gnathologie: Einführung in Theorie und Praxis*. Quintessenz Verlag. Berlin. 1978, 65p.
9. Mage K., Ćelic R., Ćimic S., Dulčić N. Comparison of Parameters for Programming Adjustable Dental Articulators by Using Wax Eccentric Records and Arcus Digma Device. *Acta Stomatol Croat*. 2019;53(3):213-223. doi: 10.15644/asc53/3/3.
10. Pavlenko S.A., Pavlenkova E.V., Tkachenko I.M. et al. Changes in the functional condition of the masticatory muscles with increased teeth abrasion. *Wiad Lek*. 2019;72(5):1002-1006.
11. Thompson G.A., Nick C., Francisco P. et al. Comparison of two arbitrary cast transfer systems with a kinematic facebow for mounting a maxillary cast on a semiadjustable articulator. *J Prosthet Dent*. 2021. doi: 10.1016/j.prosdent.2020.12.023.
12. Lepidi L., Galli M., Mastrangelo F. et al. Wang Virtual Articulators and Virtual Mounting Procedures: Where Do We Stand? *Journal of Prostodontics*. 2021; 30: 24-35.
13. Kordab B. The Virtual Articulator: Development and Evaluation. *International Journal of Computerized Dentistry*. 2003;6: 11-24.
14. Padrós R., Giner L., Herrero-Climent M. et al. Influence of the CAD-CAM Systems on the Marginal Accuracy and Mechanical Properties of Dental Restorations. *Int J Environ Res Public Health*. 2020;17(12):4276. doi: 10.3390/ijerph17124276.
15. Buduru S., Culic B., Talmaceanu D., Pal A. A comparative study of the accuracy of five CAD-CAM systems. *Med Pharm Rep*. 2019;92(2):185-191. doi: 10.15386/cjmed-1131.
16. Roth R.H. 1981 Functional occlusion for the orthodontist. *Journal of Clinical Orthodontics*. 1981; 15: 32-51.
17. Rinchuse D.J. The impact of the American Dental Association's guidelines for the management of temporomandibular Disorders on orthodontic practice. *Am. J. Orthod. Dentofacial Orthop*. 1983; 83(6):518-522.
18. Mohl N.D. Temporomandibular disorders: the role of occlusion, TMJ imaging, and electronic devices. A diagnostic update. *J Am Coll Dent*. 1991;58(3):4-10.
19. Lindauer S.J., Isaacson R.J., Davidovich M. Condylar movement and mandibular rotation during jaw opening. *Am J Orthod Dentofacial Orthop* 1995; 107:573-7.
20. Cordray F.E. Centric relation treatment and articulator mountings in orthodontics. *Angle Orthod*. 1996;66 (2): 153-158.
21. Clark J.R. et al. Functional Occlusion: II. The Role of Articulators in Orthodontics *Journal of Orthodontics*. 2001; 28(2): 173-177.
22. Alpern M.C., Alpern A.H. Innovation in dentistry: the polycentric occlusal system. In: Alpern MC, editor. *The ortho evolution— the science and principles behind fixed/functional/splint orthodontics*. Bohemia, NY: GAC International. 2003, 68 p.
23. Jacobson A. Does articulating study casts make a difference to treatment planning? P.E. Ellis and P.E. Benson *Journal of Orthodontics*. 2003;125(30):45-9.
24. Kelleher R. Common sense, open mind needed. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2006;129(6): 719.
25. Port R.M. Articulators and gnathology: better care is the real goal. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2006;129(6): 718.
26. Rinchuse D.J., Kandasamy S. Articulators in orthodontics: An evidence-based perspective. *American Journal of Orthodontics and Dentofacial Orthopedics*. February. 2006; 129:299-308.
27. Rinchuse D.J., Kandasamy S., Rinchuse D.J. Word of mouth—articulators in orthodontics: chewing the facts. Part 1. *Orthodontic Products*. 2007; 14:152-5.
28. Rinchuse D.J., Kandasamy S., Rinchuse D.J. Word of mouth—articulators in orthodontics: chewing the facts. Part 2. *Orthodontic Products*. 2007; 14:40-2.
29. Rinchuse D.J., Kandasamy S. Myths of orthodontic gnathology. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009; 136(3): 322-330.
30. Hudson J.M. Articulators in orthodontics. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012; 141(5): 528-529.
31. Rinchuse D.J., Kandasamy S. Articulators in orthodontics. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;141(5).
32. Domingo M. Renato Cocconi Orthodontic dental casts: The case for routine articulator mounting. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;141(1): 8-14.
33. Theodore D. Articulators in Orthodontics. *Freeland*. 2012;18(1): 51-62.
34. Aichinger C. Orthodontic dental casts: The case against routine articulator mounting. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;141(5): 527.
35. Wang Li, Han Xianglong, Bai Ding. The controversy of routine articulator mounting in orthodontics. *West China Journal of Stomatology*. 2013; 31(3): 323-326.
36. Inami K., Higashi Yu., Chen K.Ch. et al. Prediction of dentofacial changes induced by an articulator intended for orthognathic surgery. *J Osaka Dent Univ Japan*. 2019; 53 (2):161-169.
37. Park J.H., Lee G.H., Moon D.N. et al. A digital approach to the evaluation of mandibular position by using a virtual articulator. *J Prosthet Dent*. 2021;125(6):849-853.

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#### Conflict of interest:

*The Authors declare no conflict of interest.*

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article