Romanian Journal of Oral Rehabilitation
Vol. 13, No. 2, April – June 2021

PROCEDURE FOR THE DIAGNOSIS OF TEMPOROMANDIBULAR JOINT DYSFUNCTIONS

Andrei Fachira [1] , Carolina Susanu[2] , Șerban Paul Popa*[2] , Oana Lorena Nistor [2], Mădălina Nicoleta Matei*[2], Ovidiu Schipor[2], Gabi Topor[2], Corina Cecilia Manole Palivan[2], Sergiu Focșăneanu[2], Oleg Solomon[1]

1. SUMPh "Nicolae Testemiţianu" Faculty of Stomatology, Department of Orthopedic Dentistry "Ilarion Postolachi"
2. "Dunărea de Jos"University , Faculty of Medicine and Pharmacy, Galați, Romania

*Corresponding author: MĂDĂLINA NICOLETA MATEI ,email: madalina.matei@ugal.ro
ȘERBAN PAUL POPA, email: pserbanpaul@gmail.com

All authors had equal contributions with the first author

Abstract

The clinical examination of the temporomandibular dysfunctions regards the identification of occlusal disharmonies, the nature of muscular hyperactivity, the presence of signs/symptoms of temporomandibular joint dysfunctions.

The specificity and sensitivity of paraclinical methods, based on relevant comparative studies, represent indices that are to be used in the process of choosing and applying investigation methods. There was accomplished a retrospective analysis (a case study) of 8 patients with condyle-disk assembly dysfunctions. The symptomatic triad (arthralgia, limitation/deviation of mandibular movements, joint noises) have served preventively for the identification of the clinical form of joint dysfunction. The complex data gathered from the clinical exam allowed us to differentiate and to identify the clinical form, based on several diagnostic criteria. The graphic recording of joint vibrations (Bio-JVA,Bio-Research,USA) and the parameter analysis (vibration peak, etc.) served for confirming the initial diagnosis.

In the process of diagnosing the condyle-disk dysfunctions, the values of the parameters recorded by using the paraclinical method Bio-JointVibrationAnalysis,(Bio-JVA,Bio-Research,USA), serveas a proof for confirming the initial diagnosis.

Key words: dysfunctions of the temporomandibular joint, diagnosis of temporomandibular joint dysfunctions, graphical recording of joint vibration (Bio-JVA,Bio-Research,SUA), prosthetic dentistry.

.

Introduction

Arthrogenic temporo-mandibular dysfunction is a condition of the temporo-mandibular joint, one of the most complex joints in the body, responsible for the movement of the mandible forward, backward and sideways. Any impairment of the normal functioning of this complex system, consisting of muscles, ligaments, disc and bones is called temporo-mandibular dysfunction [1-7].

Among the multiple forms of temporo-mandibular dysfunction, we can highlight the arthrogenic temporo-mandibular dysfunction which is classified into three major clinical forms: dysfunctions of the condylar-disc assembly; morphological incompatibility of joint surfaces, inflammatory diseases of the temporomandibular joint. The dysfunctions of the condylar-disc assembly are characterized by the modification of the normal functional ratio between the mandibular condyle and the articular disc. These dysfunctions, in turn, can be divided into three types: displacement of the articular disc, reductible dislocation of the disc, irreductible dislocation of the disc [8-16].

Articular disc displacement , is most often a shift earlier articular disc. If the lower

retrodiscal lamina and the disc collateral ligaments are elongated, the superior lateral pterygoid muscle may position the disc more anteriorly relative to the condyle at joint resting conditions. When muscle traction is constant, there is a progressive thinning of the posterior edge of the disc. Consecutively, the disc will be moved more and more in the anterior direction, and the condyle comes into contact with the disc in an increasingly posterior area, at articular rest. The condyle will perform an abnormal translational movement on the disc when the mouth is opened. It is associated with the production of a single crack (only when the mouth is opened) or vice versa (both when the mouth opens and closes). In the anamnesis, the patient may associate a trauma with the appearance of joint noises. Sometimes he perceives a pain of intracapsular origin at the moment of the cracking.

Objective clinical features are joint noises when opening or closing the oral cavity (reciprocal cracking). The cracking during the opening movement occurs in the middle of it, and the cracking during the closing of the oral cavity occurs near the maximum intercuspid position. Normal amplitude of mandibular movements when opening the oral cavity and in eccentric positions. Any limitation of them is secondary to pain, not being caused by a real structural dysfunction [17-23] .

In the case of reductible dislocation of the disc , in the resting joint position, the disc may jump completely before the condyle, if the lower retrodiscal lamina and collateral ligaments have been sufficiently elongated and the posterior band of the disc has been greatly thinned. The tone of the lateral pterygoid muscle will usually pull the disc in the antero-medial direction[24-28].

Subsequently, the condyle comes in relation to the retrodiscal tissues, not to the surface of the disc. If the patient can move the mandible so as to receive the condyle on the posterior edge of the disc it is a reductible dislocation of the disc. When the oral cavity is opened, the condyle performs a sudden translational movement over the posterior edge of the disc. The condyle then adopts a normal relationship with the intermediate area of the disc. When the oral cavity closes, the stretched fibers of the upper retrodiscal lamina ensure the return of the condylar-disc assembly to the resting joint position. The amplitude of the disc dislocation is determined by the disc ligaments and the disc morphology. An overactivity of the superior lateral pterygoid will aggravate the antero-medial dislocation of the disc, due to a slight elongation of the superior retrodiscal lamina, thus losing its elasticity. The upper retrodiscal lamina is the only joint component that can exert posterior traction of the disc. In the anamnesis, the patient may have joint noises for a long time. Often, patients associate their appearance with an open-mouth macrotrauma or a microtrauma caused by chronic muscle hyperactivity and orthopedic instability. The pain occurs when the patient grits his teeth in maximum intercuspation. The contraction of the muscle pterygoid disc forces the upper side and further the antero-medial direction. Tension of the already elongated disc ligaments causes pain. The data of the objective clinical examination of the patient initially show a limitation of the opening movement[29-34].

The reduction of the dislocation of the articular disc is accompanied by the deviation of the opening tract towards the affected part, accompanied by a strong crack. In the case of older dislocation, a feeling of blocking the opening movement may occur, which can be painful. During mandibular movements there is a reciprocal crack associated or not with joint pain, defined as: an intermediate crack during

opening, caused by the translation of the condyle over the posterior edge of the disc in the presence of an increased level of intra-articular pressure, a crack in the final phase of closure when the posterior traction exerted by the upper retrodiscal lamina on the disc is reduced.

Keeping the mandible in the protruding position, after recapturing the disc, eliminates the feeling of blockage when opening the oral cavity and the crack, the eccentric movements of the mandible are of normal amplitude. The compression test is positive. Pain occurs by compression of the retrodiscal tissues by the condyle [1, 16].

The irreductible dislocation of the disc is characterized by some peculiarities, in the position of articular rest, the condyle thus comes in relation to the retrodiscal tissues. If during the opening movement, the condyle no longer has the ability to resume its position on the surface of the disc, the normal anterior translation of the condyle is blocked by the permanently dislocated anteromedial disc, the appearance of the irreductible anterior dislocation of the disc.

In the anamnesis, the patient can specify exactly when the dislocation becomes irreductible. The normal opening movement of the oral cavity is suddenly blocked.

The patient describes a history of joint symptoms that have progressively worsened. The cracks disappeared completely when the dislocation became irreductible. The pain only occurs if the patient forces the mouth open.

An objective clinical feature is the amplitude of the opening movement, it is limited to 20-25 mm in the case of recent irreductible dislocations. The pain occurs when the opening of the oral cavity is forced beyond the limit imposed by the dislocated disc. During the opening movement of the oral cavity, the mandible deflects towards the affected temporo-mandibular joint. Eccentric movements of the mandible are relatively normal to the ipsilateral side and limited to the contralateral side. The compression test is positive, as the condyle stresses the retrodiscal tissues and causes joint pain [1, 16].

Dysfunctions of the condylar-disc assembly are clinically characterized by signs and / or symptoms depending on the severity of morphological changes in the elements of the joint complex, as well as the influence of etiological factors [10,16]. The diversity of paraclinical methods of examination of the temporo-mandibular joint during the last decades has created several disputes among researchers and clinicians, regarding the veracity of the information obtained.

Currently, in the context of aspects of the diagnostic process, characteristic of evidence-based medicine, various indicators are being analyzed that could guide clinicians to select paraclinical methods of investigation.

Respectively, such parameters as the specificity and sensitivity of paraclinical methods, determined on the basis of relevant comparative studies, are useful in understanding and applying the chosen method. In this context, the BioJVA paraclinical investigation method (BioResearch Associates, Inc. , USA) has certain peculiarities in application and interpretation, there are only a few basic waveforms of waves that can be observed when recording joint vibrations.

When analyzing these, attention is drawn to a series of indices: a) amplitude level (Total Integral coefficient - numerical summation value of recorded frequencies), which can be: low vibrations - 0-20 KpaHz, medium vibrations - 20-80 KpaHz , high vibrations - 80-

300 KpaHz, very high vibrations - 300-1000 KpaHz ; b) duration (number of complete cycles); c) the level of transfer to the contralateral joint.

Figure 1 shows a clinical case with reductible disc displacement in which a high amplitude of vibrations can be observed (Total Integral>80); a short duration (only 1-2 cycles) complete and a transfer to the contralateral joint. The "vert" line that can be seen on this graph indicates that the reduction occurs at the end of the closing motion, which suggests that the condition is chronic.

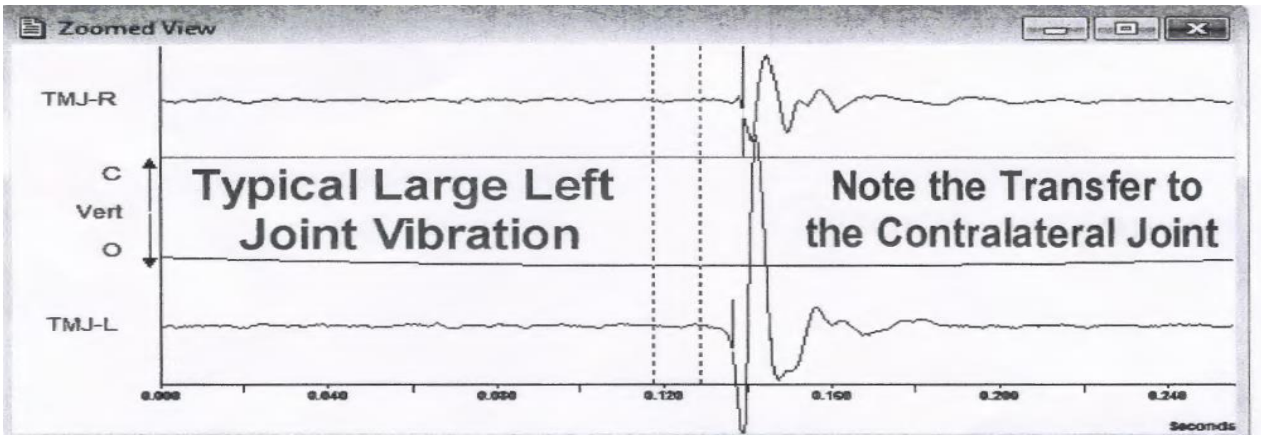

Fig.1 Analysis of vibration waves specific to the partially reductible disk

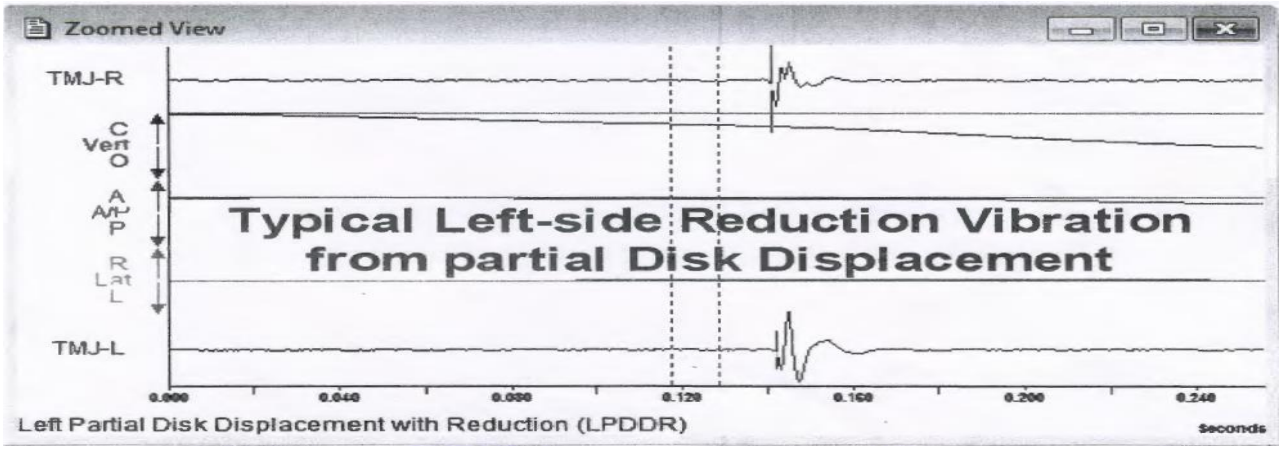

Fig.2 Partially reductible disc displacement of the left side disc.

In case of partially reductible disk displacement, a vibration graph can be observed as in the case of complete disk displacements, but with lower amplitude, namely: a) moderate amplitude - *Total Integral* = 20 to 80; b) short duration (only 1 or 2 cycles); c) sometimes there is a transfer to the contralateral joint. The green line "Vert" indicates this vibration, it appears relatively early during the opening movement, which suggests that the condition is acute.

The general characteristics of vibrations in the case of degenerative clinical forms are:

a) lower amplitudes; b) long duration with several cycles, the process of joint degeneration begins with structural changes of the articular cartilage, a process similar to degenerative diseases of other joints (knee chondromalacia).

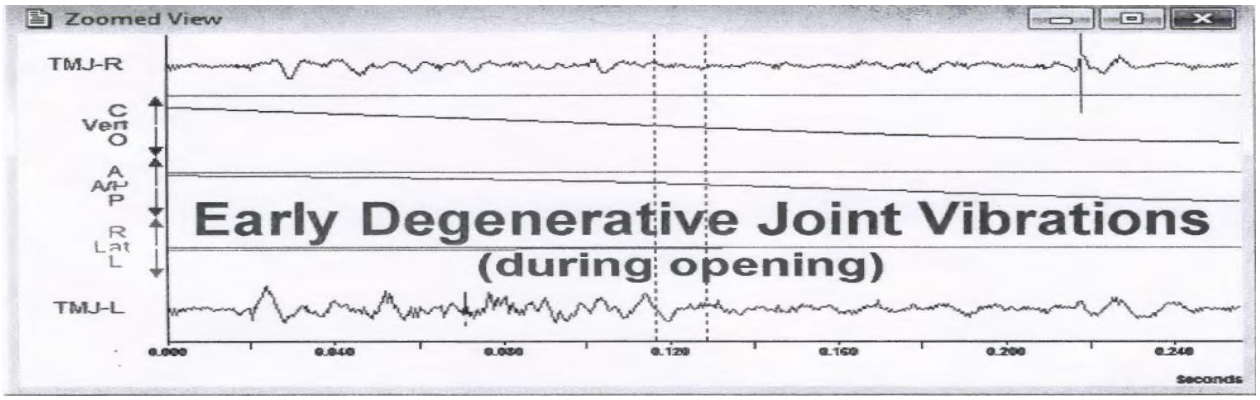

Fig.3 Early degenerative changes in the temporo-mandibular joint at the opening movement.

The absence of joint vibrations recorded by BioJVA is not a sign of "health", "normality" or "good function" [12].

Some clinical forms, such as acute disc movement without reduction (*closed lock*) is usually free of vibration at the initial stage . Over time, joint vibrations occur but of low amplitude in case of adaptation and compensation of the disease. Figure 4 shows the presence of minimal vibration, except for those generated by dental contact, in a patient with acute disc movement without reduction. In such cases, the "tuning fork opening movement" (ROM - *Range of motion*) is an essential factor required for indetificarea and differentiation of clinical forms.

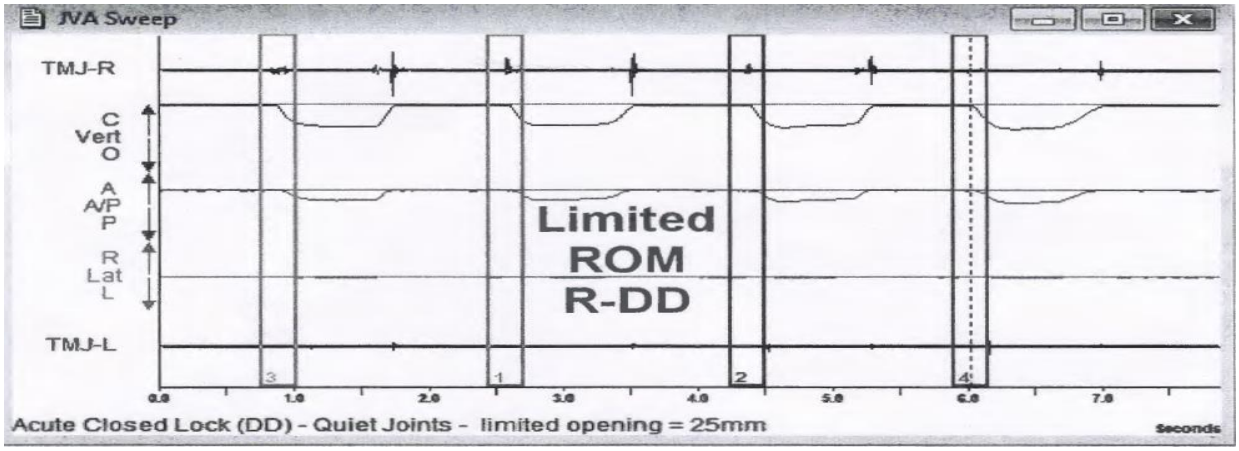

Fig. 4 Limiting the range of the opening movement (ROM) in case of acute *closed lock* , with the limitation of the opening to 25 mm.

In contrast to the previous graph, Figure 5 shows the lack of vibration in a patient with " *normal* " joints with a ROM> 40 mm.

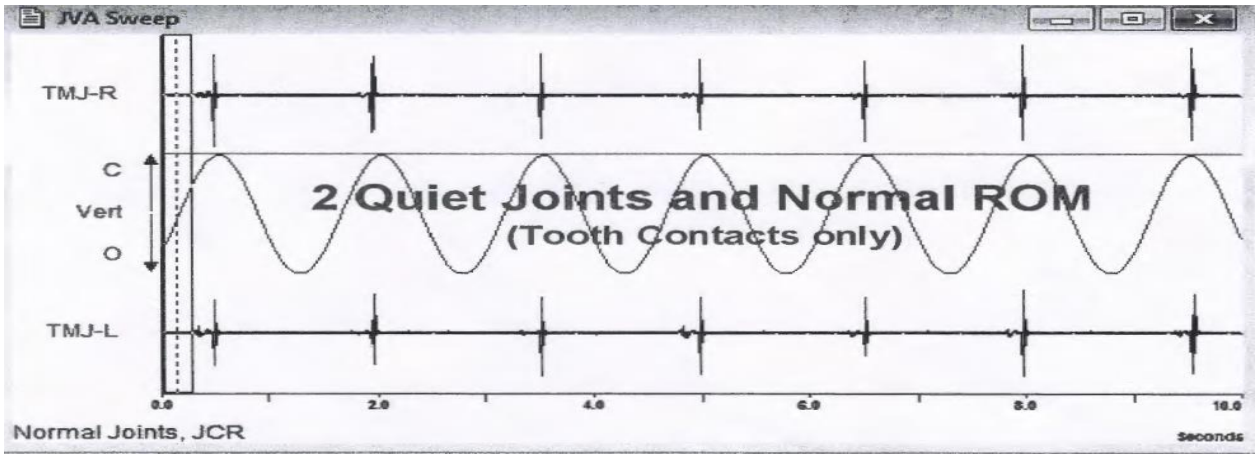

Fig. 5 Recording of vibrations on dental contact in *BioJVA* in a person without symptoms of damage to the temporomandibular joints.

According to Radke, in the case of chronic structural disorders of the temporomandibular joint, it is usually attested to adapt to them, without significant complaints from patients; acute structural disorders have a more pronounced clinical picture with algae and functional problems (chewing difficulties, limited opening of the oral cavity, etc.).

Significance of mandibular position at the onset of vibration

In the literature it is known as an early reduction of the displaced disc, during the opening movement it indicates the presence of an acute form of dysfunction, while the reduction at a later stage of the disc indicates the presence of a chronic form of the disease.

Clinically, disc recapture attempts are more effective in acute forms.

In chronic clinical forms, functional movements are usually performed "outside the disc", these forms usually do not allow permanent recapture of the disc except for surgery.

If such a clinical form is not accompanied by algae or discomfort in the performance of the function, then the goal of recapture of the disc is not necessary.

Thus, it becomes relevant to determine the position of the mandible at the onset of joint vibrations.

The *Joint Vibration Analysis* method can determine the position of the mandible, especially if it is used for examination and a specialized *Jaw tracker* device (JT-3D).

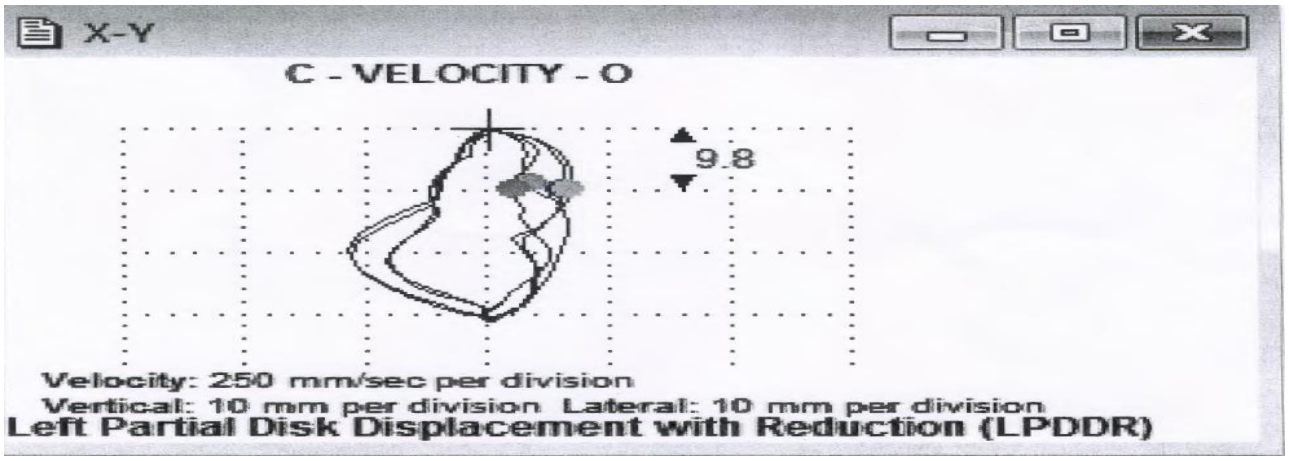

Fig. 6 Combined recording of joint vibration (BioJVA) and limit movements in a patient with partially reductible disc displacement

In Figure 6 it can be seen that the onset of vibration occurs in the first 10 mm of the opening movement, which is considered an "early one".

For this clinical case, the diagnosis of partial reductible disc displacement is established, the acute form, in which the recapture of the disc can be attempted.

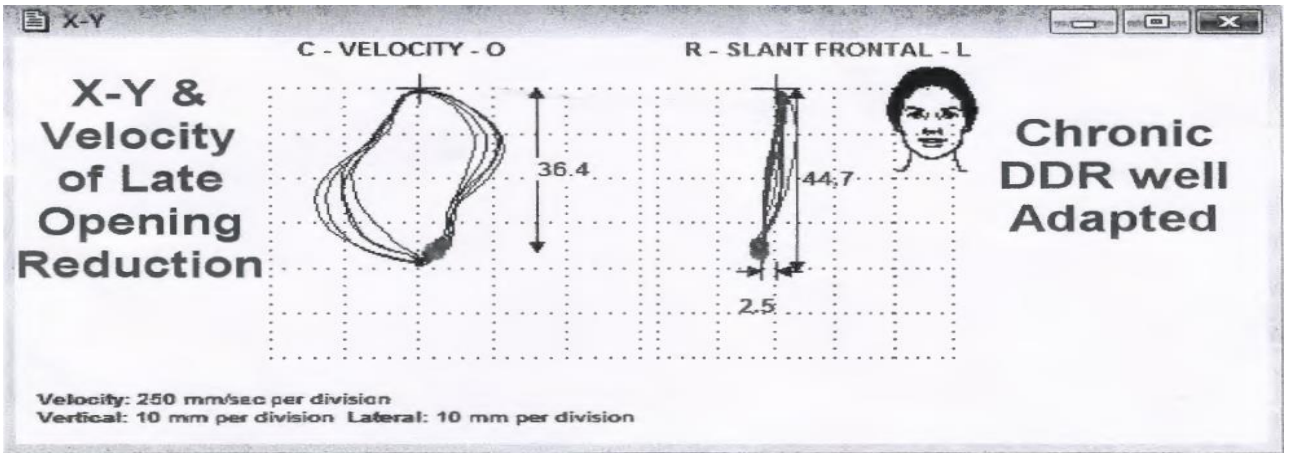

Fig. 7 Combined recording of joint vibration (BioJVA) and limit movements in a patient with chronic partial reducTible disc displacement, compensated form.

In Figure 7 you can see a chronic partial reductible displacement of the disc, compensated shape, the patient adapting to this form of dysfunction, in such cases the movements are performed "outside the disc", the reduction being possible only when yawning, or other large amplitude movements.

In such cases of perfect adaptation, the retrodiscal tissues form a so-called pseudo-disc, so it can be considered that the functioning of the system in such conditions is less traumatic compared to the constant reduction and displacement.

When adaptation is lacking, functionality suffers. In this case the onset of vibration takes place at different stages of the opening movement.

Speed is also lower when the patient tries to open and close the mouth smoothly.

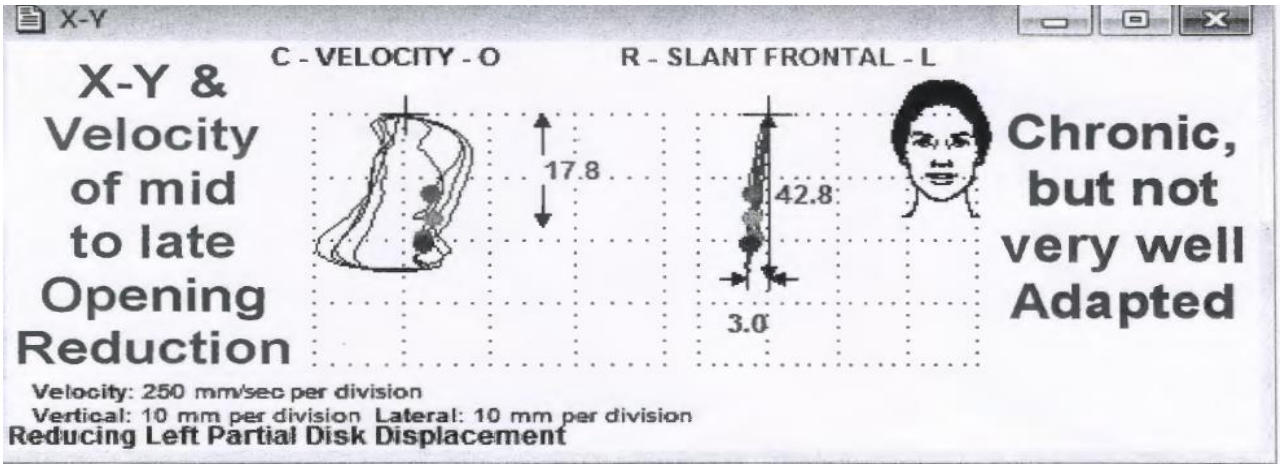

Fig. 8 Combined recording of joint vibrations (BioJVA) and limit movements in a patient with chronic partial reductible disc displacement, decompensated form.

Bio-JVA (Joint Vibration Analysis) is based on the principle of movement and friction: during the excursion of the mandible between the articular surfaces the rotation and translation takes place, thus the friction phenomenon occurs, which determines the appearance of vibrations. Normally, when human joints are lubricated during mandibular movements, the vibrations produced by friction are minimal. If the joint surfaces become rough as a result of degeneration of their morphology, or when the disk displacement occurs , the vibration spectrum changes . Joint Vibration Analysis provides the method for rapid, repeatable and non-invasive measurement of temporo-mandibular joint function and functional diagnosis of temporo-mandibular dysfunctions. Understanding the function of the temporo-mandibular joint is important when there is a vertical, lateral or antero-posterior change in the position of the mandible. Different pathologies of the temporo-mandibular joint can produce different specific vibrations. Computerized analysis of these vibrations, allows their recognition and association with various dysfunctions of the temporomandibular joint. The recording of the Joint Vibration Analysis takes very little, 3-5 minutes and consists in the installation of headphones equipped with vibration sensors in the pretragian region applied on the skin tissues laterally by the temporo-mandibular joint. The patient is asked to perform opening and closing movements of the oral cavity 5-6 times. The computer system will then analyze the vibrations and provide the data for evaluation. Depending on the intensity of the vibrations produced during the mandibular movement, the computer system will offer us 4 types of possible results. The analysis of the results received through the Bio JVA device is analyzed with the help of the diagram. All possible vibrations at an amplitude were divided into 4 classes: low vibrations 0 - 20 KPaHz, medium vibrations 20 - 80 KPaHz, high vibrations 80 - 300 KPaHz, very high vibrations 300 - 1000 KPaHz. Small vibrations usually occur in patients with: normal joint, disc displacement, acute irreductible dislocation, end-stage osteoarthritis. Mean vibrations occur in patients with: chronic irreductible displacement with adaptation, chronic irreductible dislocation associated with osteoarthritis. High vibrations usually occur in patients with: reductible disc dislocation . Very high vibrations occur in patients with:

morphological incompatibility, perforation of the disc or retrodiscal tissues [12].

Material and methods:

8 patients with arthrogenic temporo-mandibular dysfunctions characteristic for dysfunctions of the condylar-disc assembly were examined and selected . Characteristics of patients: 5 women, 3 men aged 42-60 years old. The examination scheme was based on some principles of examination and diagnosis which included certain symptoms and signs of diagnostic guidance and the determination of etiological factors supported by anamnestic and clinical arguments. The scheme included the distinct stages in a certain succession: anamnesis, functional clinical examination of the dentomaxillary apparatus, conventional radiographic techniques, if necessary examining the study models mounted in the simulator, *BioJVA.* Attention was drawn to the pain, noise and asymmetry of the condylar excursions. Pain or tenderness of the temporo-mandibular joint is determined by palpating the joint when the mandible is at rest or during movement. The tips of the middle fingers are placed simultaneously pretragian, and the patient is asked to open and close the oral cavity, at the maximum opening the doctor's fingers rotate slightly posteriorly and exert pressure on the posterior surface of the condyle, so inflammation of tissues that are painful can be detected. pressure. It is preferable to avoid the examination by placing the fingers in the external auditory canal, being possible to push the cartilage in the posterior area, falsifying the results. *Bio-JVA Joint Vibration Analysis* is based on the principle of movement and friction: during the excursion of the mandible between the joint surfaces rotation and translation occurs so the phenomenon of friction occurs, which causes vibration, normally when human joints are lubricated. During mandibular movements, the vibrations produced by friction are minimal. If the joint surfaces become rough as a result of degeneration of their morphology, or when the disk displacement occurs, the vibration spectrum changes. Bio- JVA is a method of rapid, repeatable and non-invasive measurement of temporo-mandibular joint function and functional diagnosis of temporo-mandibular dysfunction. Understanding the function of the temporo-mandibular joint is important when there is a vertical, lateral or anterio-posterior change in the position of the mandible. Different pathologies of the temporo-mandibular joint can produce different specific vibrations. Computerized analysis of these vibrations, allows their recognition and association with various dysfunctions of the temporomandibular joint.

Results and discussions

In this study, a retrospective analysis of 8 patients with arthrogenic temporomandibular dysfunction was performed . Table 1 presents the data regarding the persons studied

Table 1 General characteristic of the study group

No	Sex	Age	ccused
1	F	43	ain localized in the preauricular region, cracks
2	F	56	ain localized in the preauricular region, cracks
3	F	46	iffuse pain, crackling
4	M	55	miting opening movements, cracking
5	F	42	miting opening movements, cracking
6	M	60	udden blockage of the opening of the oral cavity; cracmente antecedent
7	M	58	udden blockage of the opening of the oral cavity; cracking and blocking ackground
8	F	53	udden blockage of the opening of the oral cavity; cracking and blocking ackground

As can be seen, the study included 3 males and 5 females. The age of patients varies between 42 and 60 years, the average being 51.6. When addressed to, the patients mainly complained of pain, blockages of the opening of the oral cavity, cracks. The duration of referral to the doctor from the onset of the disease varied from 2 days - 1.5 years (Table 1, Fig. 9)

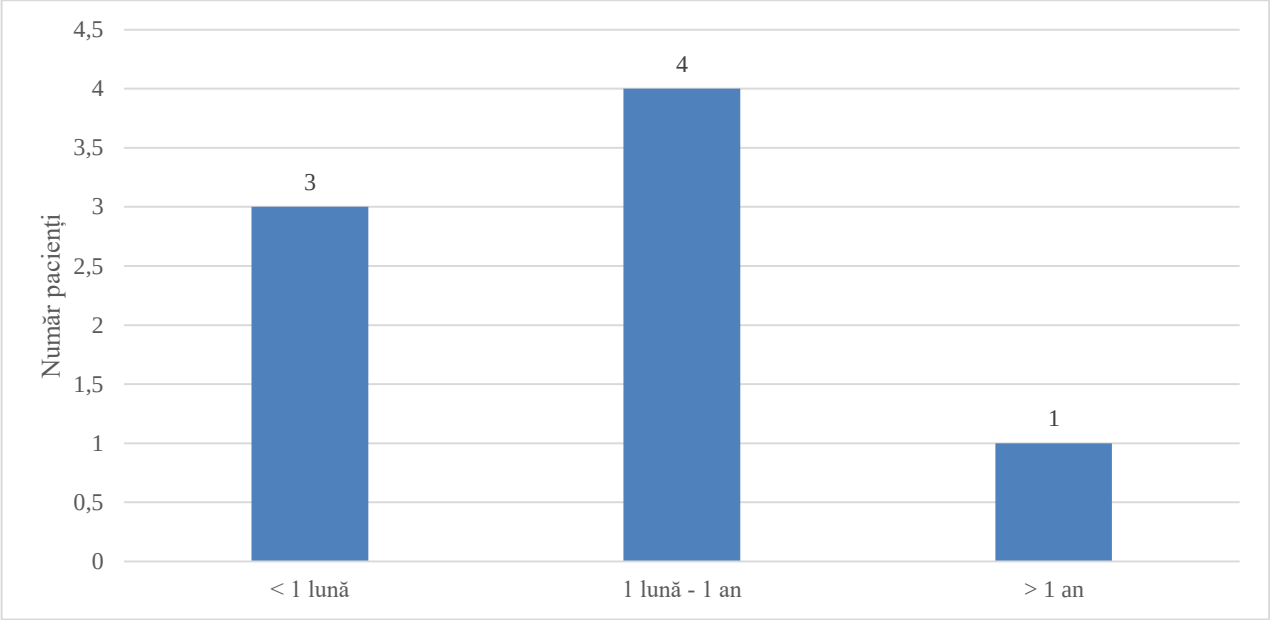

Fig. 9 Distribution of patients after seeing the doctor.

After addressing, in order to establish the diagnosis, patients underwent different methods of functional, paraclinical clinical examination (Table 2).

Tabelul 2 Results of clinical and paraclinical examination

NOT.	Clinical exam			Exam paraclinically	Diagnostic	NOT.
	Inspection	Palpation	Auscultation			
	Closing / opening movement of the oral cavity "in bayonet"	Muscle and joint palpation without pain	Unilateral crack on the left	OPG	DTM reductible	
	Closing / opening movement of the oral cavity "in bayonet"	Muscle and joint palpation without pain	Reciprocal crackles	OPG	DTM reductible	
	Closing / opening movement of the oral cavity "in bayonet"	Painless muscle palpation Sensitive joint palpation	Reciprocal crackles	OPG	DTM reductible	
	Closing / opening movement of the oral cavity "in bayonet"	Muscle and joint palpation without pain	Reciprocal crackles	OPG	DTM reductible	
	Closing / opening movement of the oral cavity "in bayonet"	Muscle and joint palpation without pain	Reciprocal crackles	OPG	DTM reductible	
	Closing / opening movement of the oral cavity - deviated to the left	Muscle and joint palpation without pain	No noise	OPG	DTM reductible	
	Closing / opening movement of the oral cavity - deviated to the left	Muscle and joint palpation without pain	No noise	OPG	DTM reductible	
	Closing / opening movement of the oral cavity - deviated to the right	Muscle and joint palpation without pain	No noise	OPG	DTM reductible	

Thus, the inspection established a deviation of the closing / opening movement of the oral cavity in the form of a "bayonet" in 5 patients, and in 3 patients an ipsilateral deflection of the mandible was detected (at 2 - to the left; at 1 - to the right). At the same time, the muscle and joint palpation did not produce pain sensations in any patient, while the compression test was positive in all patients. Auscultation showed unilateral cracks on the left in 1 patient, in 4 patients - reciprocal cracks, and in 3 patients no noises were identified.

The paraclinical examination consisted in performing routine orthopantomography in all patients in order to exclude conditions that endanger the patient's life, such as neoplasms that mimic a temporo-mandibular dysfunction.

As a result of the investigations, the clinical diagnosis was established: in 5 patients a temporo-mandibular dysfunction with reductible joint disc dislocation was

established, and in 3 patients - a temporo-mandibular dysfunction with irreductible dislocation of the articular disc (Fig. 10).

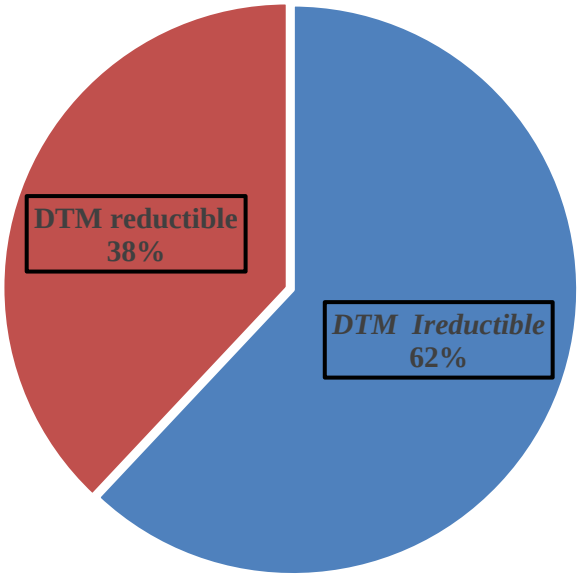

Fig. 10 Graph of patient distribution by clinical diagnosis and devices applied in reversible occlusal therapy.

During the treatment it was recommended to apply the muscle relaxation rail according to the diagnosis of temporomandibular dysfunction with dislocation of the articular disc (5 patients) and the application of the anterior repositioning rail to patients diagnosed with temporomandibular dysfunction with irreductible joint disc dislocation (3 patients).

Bio-JVA is intended for the analysis of vibrations in the temporomandibular joints on the principles of movement and friction. Friction and insignificant vibrations occur on contact with smooth surfaces. When these surfaces become rough, the touch and friction become stronger. Respectively the temporo-mandibular joint, the surfaces of the articular elements that are satisfactorily lubricated, with a satisfactory biometric correlation practically do not produce friction and vibration. When the surfaces change, as a result of disorders, damage, immobilization or movement of the joint disc, it eventually produces frequent vibrations. Respectively, different disorders have different wave patterns.

Computerized analysis of these drawings helps to correctly identify and determine the disease of the temporo-mandibular joint. The examination of the results received by means of the Bio-JVA apparatus is analyzed with the help of the diagram (Fig. 11).

All possible vibrations at an amplitude were divided into 4 classes:

- *Low* vibrations - 0-20 KpaHz;

- Vibration *medi* - KpaHz 20-80;

- *High* vibrations - 80-300 KpaHz;

- *Very high* vibrations - 300-1000 KpaHz.

Small vibrations usually occur in patients with: normal joint, disc movement, acute irreductible dislocation, end-stage osteoarthritis.

Medium vibrations occur in patients with: chronic irreductible displacement with adaptation, chronic irreductible dislocation associated with osteoarthritis.

High vibrations usually occur in patients with: reductible disc dislocation.

Very high vibrations occur in patients with: morphological incompatibility, perforation of the disc or retrodiscal tissues [12].

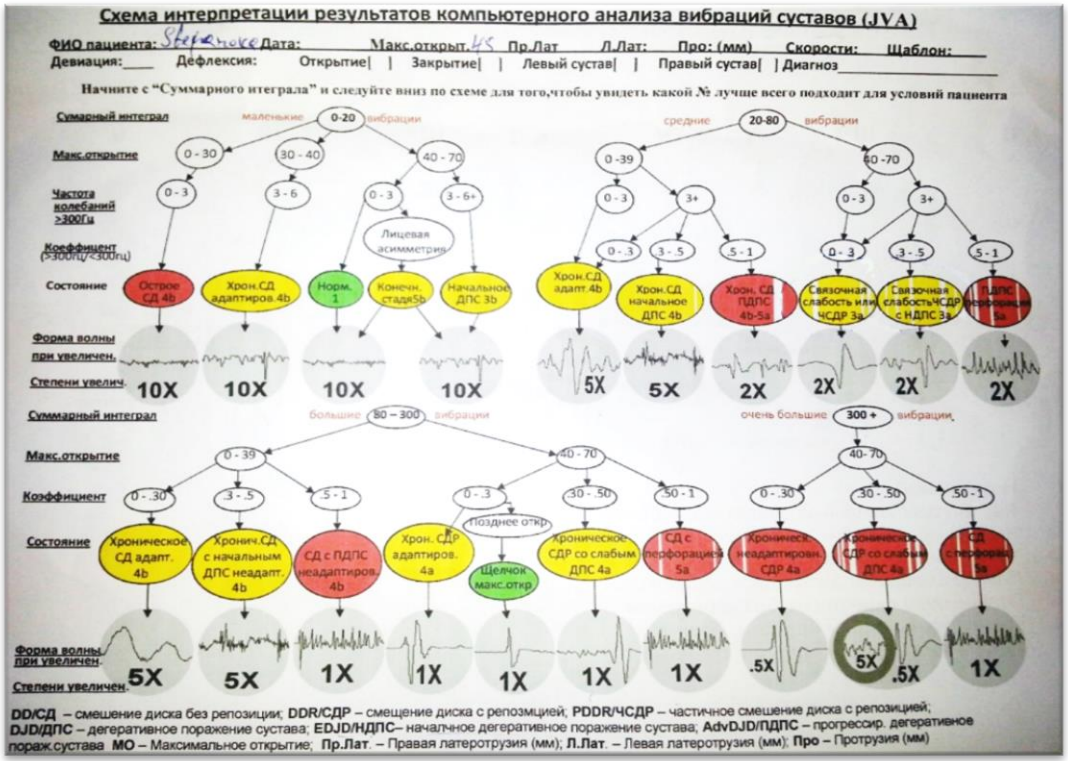

Fig.11 Examination of the results received through the *Bio-JVA* device

The analysis of the diagram shows us average vibrations of 80 KPa Hz, the line ″Vert″ appears on the graph showed us that the reduction occurred at the end of the closing movement, which suggests that the condition is chronic - figure 12

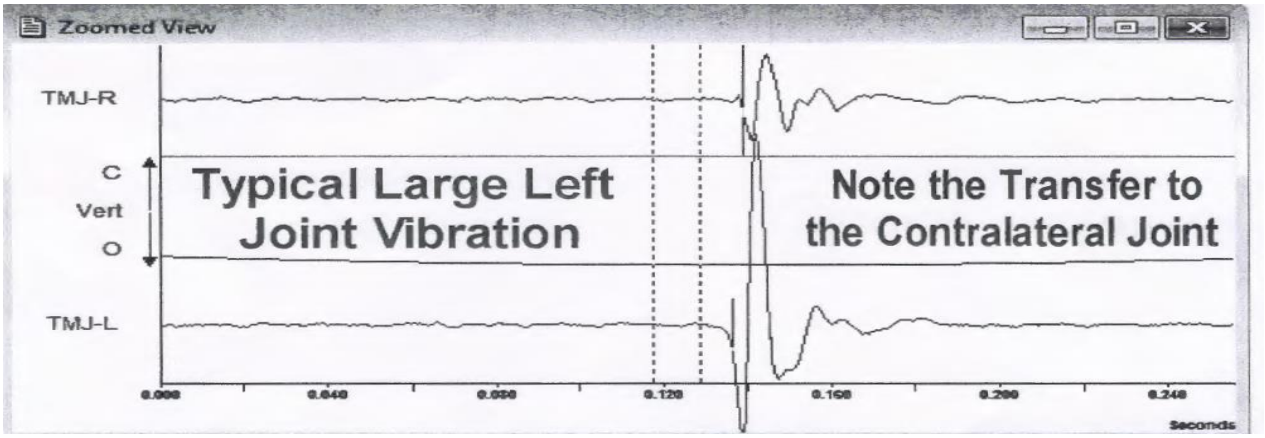

Fig. 12 Analysis of vibration waves specific to the partially reductible disk displacement.

Following the data of the clinical and paraclinical examination by the *Bio-JVA* method, the clinical diagnosis of: Arthrogenic temporo-mandibular dysfunction, the clinical form of chronic reductible dislocation of the articular disc, the impact of psycho-emotional stress, with a favorable prognosis was confirmed .

General conclusions:

1. The clinical picture of joint dysfunction of reductible joint disc dislocation is characterized by certain signs and symptoms of diagnostic orientation.
2. The analysis of the data of the complex clinical examination, in the patients with the reductible dislocation of the articular disc, allowed the formulation of the preventive clinical diagnosis.
3. The correlation of the values of the parameters of the Bio-JVA paraclinical method (Bio-Research, USA) with the results of the clinical examination, allowed the confirmation of the veracity of the clinical diagnosis.

References

1. Burlui V., Forna N., Ifteni G. Clinic and therapy of reduced intercalated partial edentation. Iași: Ed. Apollonia, 2001, 638 p.
2. D e Félicio C. , Freitas R. , Bataglion C. The effects of orofacial myofunctional therapy combined with an occlusal splint on signs and symptoms in a man with TMD hypermobility . J Orofacial Myology, 2007, pp. 9-33.
3. Dodić S., Sinobad V., Obradović-Djuricić K., Medić V. The role of occlusal factor in the etiology of temporomandibular dysfunction. Srp Arh Celok Lek, 2009, vol 137 (11-12), pp. 613-618.
4. E. Ekberg, D Vallon . Efficacy of device therapy in patients with temporomandibular disorders of predominantly myogenic origin. A randomized, controlled, short-term study . J Orofac Pain, 2003, vol 17 (2) , pp. 133-139.
5. Forna N., De Baat C., Lascu L., Pauna M. Protetica Dentara (volume II). Bucharest: Ed. Enciclopedică, 2011, 703 p.
6. Greene C. Managing the care of patients with temporomandibular disorders, a new orientation for care. J Am Dent Assoc, 2010, vol 141 (9), pp. 1086- 108 8.
7. Kerstein R., Radke J. The accuracy of the clinician in the subjective interpretation of articulation paper markings. Dental Medicine, no. 3 (32), 2014, pp.87-95.
8. McGoldrick D . , Stassen L . Management of acute dislocation of the temporomandibular joint in dental practice. J Ir Dent Assoc, 2011, vol 56 (6), pp. 268-270.

9. Okeson J., de Leeuw R. Differential diagnosis of temporomandibular disorders and other orofacial pain disorders. Dent Clin North, 2011 vol 55 (1), pp. 105-120.
10. Pântea V., Fala V., Gribenco V., Nistor L. Complex morphofunctional rehabilitation of patients with bilateral terminal partial edentations and mandibulo-cranial dysfunctions. Dental Medicine, no.3 (28), 2013, pp. 89-95.
11. Postolachi I., Chiriac E., Șeptelici I., Cojocaru M., Banuh V., Bîrsa G., Cojuhari N., Guțuțui V., Gamureac V. Dental prosthetics. Chisinau: PEI "Science", 1993, pp. 31-46, pp. 193-202.
12. Radke J., Sethi M. Marking, analysis and treatment planning from JVA data. BioResearch Associates Inc., 2013.
13. Șcerbatiuc D., Iovu G. Dysfunctions of the temporo-mandibular joint. Dental Medicine, no. 2 (31), 2014, pp.13-19.
14. Șcerbatiuc D., Iovu G. The use of occlusal capes in the treatment of temporomandibular joint dysfunctions. Dental Medicine, no. 1 (34), 2015, pp. 13-23
15. Stegenga B. Nomenclature and classification of temporomandibular joint disorders. J Oral Rehabil, 2010, 37 (10) , pp. 760- 76 5 .
16. Sylvester D., Exss E., Marholz C., Millas R., Moncada G. The association between disc position and degenerative bone changes of temporomandibular joints: an imaging study in subjects with TMD. Cranio, 2011, vol 29 (2), pp. 117-126
17. Popescu, Vasilica; Vasluianu, Ecaterina; Forna, Norina-Consuela; et al.,Comparative Study of the FTIR Analysis and the Performances of N,N,N-trimethyl Chitosan as Wrinkle-proofing Agent ,Revista de chimie , Volume: 64 Issue: 11 , 2013, Pages: 1284-1294
18. Coman, M.; Chiscop, I.; Matei, M. N.; et al.,Dynamics of Biochemical Changes in Viral B Virus Hepatitis, Revista de chimie Volume: 66 Issue: 12 Pages: 2144-2146 Published: DEC 2015
19. Petcu,A.,Savin ,C.,Balan,A.,Biomaterials involved in frontal area restorations in pediatric dentistry,Biomaterials Involved in Frontal Area Restorations in Pediatric Dentistry,Rev.Chim., 69(12), 2018 ,Pages: 3473-3476
20. Ciocan-Pendefunda, A.A.; Apostu, A.M.; Antohe, M. E.; et al., The aspects of morpho - functional restoration of endodontically treated teeth, Romanian journal of oral rehabilitation Volume: 12 Issue: 2 , 2020, Pages: 128-136
21. Mitrea, Mihaela; Niculescu, Simona; Dmor, Allia; et al., Esthetic rehabilitation with implants-supported fixed dentures after periodontitis, Romanian Journal Of Oral Rehabilitation Volume: 13 Issue: 1 , 2021, Pages: 102-113
22. Bobeica, C.; Niculet, E.; Craescu, M.; et al., Etiological factors of systemic sclerosis in the southeast region of Romania, Experimental and therapeutic Medicine Volume: 21 Issue: 1 Article Number: 79 Published: JAN 2021
23. Gheorghe, D. N.; Foia, L.; Toma, V.; et al., Hepatitis C Infection and Periodontal Disease: Is there a Common Immunological Link?, Journal OF Immunology Research Volume: 2018 Article Number: 8720101 Published:
24. Bahrin, L. G.; Lungu, N. C.; Forna, N. C.; et al. Zwitterionic 3-(1,3-Dithiol-2-ylium)phenolates, Revista DE Chimie Volume: 64 Issue: 11 Pages: 1343-1346 Published: NOV 2013
25. Radoi, V.; Kozma, A.; Toma, V.; et al., Differential diagnosis and genetic testing for determining the molecular causes underlying oro-dental anomalies in a series of patients, Romanian Journal Of Oral Rehabilitation Volume: 11 Issue: 2 , 2019, Pages: 90-95
26. Feier R. D., Forna N., Dascalu C. G.; et al., Career opportunities for dental students through european projects, Romanian Journal of Oral Rehabilitation, Volume: 9 Issue: 3, , 2017, Pages: 114-118
27. Scutariu, M. M.; Macovei, G.a; Ciurcanu, O..E; et al., Contributions to the characterization of biocenosis complex of the ecosystem in the oral cavity, Medical-surgical journal-revista medico-chirurgicala Volume: 121 Issue: 4, 2017 Pages: 801-805
28. Gradinaru, I.; Ignat, L.; Giurgiu, L.-C.; et al., Study on the Surface Condition of Composite Biomaterials Related to Saliva pH, Materiale Plastice Volume: 57 Issue: 3 , 2020, Pages: 174-179
29. Murariu, A.; Dinu, C.; Forna, D. A.; et al., Composite Resins - Multifunctional Restorative Material and Practical Approaches in Dental Field, Materiale Plastice Volume: 57 Issue: 2, 2020, Pages: 276-284

30. Hurjui L.L.; Serban L.I.; Hurjui I.; et al., The value of salivary biomarkers in oral cancer diagnosis, Romanian journal of oral rehabilitation Volume: 12 Issue: 2 , 2020, Pages: 59-64,
31. Murariu, A.; Hanganu, C.; Bobu, L.; et al., Comparative study of oral health systems in Europe, Romanian Journal Of Oral Rehabilitation Volume: 12 Issue: 4. 2020, Pages: 11-17
32. Jipu R.; Serban I.L, Hurjui L.; et al., Taste sensitivity variations in different systemic diseases, Romanian journal of oral rehabilitation, Volume: 12 Issue: 2, 2020 Pages: 212-219
33. Cretu, Cosmin; Agop-Forna, Doriana; Forna, Norina-Consuela, Computerized techniques used for 3d printing in proshodontics. a systematic review, Romanian Journal Of Oral Rehabilitation Volume: 13 Issue: 1, 2021, Pages: 25-36
34. Bolat, M.; Bosinceanu, D. G.; Sandu, I. G.l; et al. Comparative Study on the Degree of Bacterial Biofilm Formation of Dental Bridges Made from Three Types of Materials, Materiale Plastice Volume: 56 Issue: 1 Pages: 144-147 Published: MAR 2019
35. Cretu, M. S.; Grigore, A. C; Maier, A.; et al., Early Stratification of Sepsis Using Presepsine in Emergency Department (North-East of Romania Experience), Materiale Plastice Volume: 54 Issue: 1, 2017, Pages: 190-193