Complex Rehabilitation of Orthodontic Pathology Combined with Temporomandibular Joint Disorders

Kompleksowa rehabilitacja schorzeń ortodontycznych u osób z zaburzeniami skroniowo-żuchwowymi

DOI: 10.36740/ABAL202204113

Yuriy Rybert[1], Anatoliy Potapchuk[2], Lidiia Minko[1], Nataliya Magera[1], Yaryna Semchyshyn[1], Maksym Dubas[1], Vasyl Almashi[2]

[1]Danylo Halytsky Lviv National Medical University, Lviv, Ukraine
[2]Uzhhorod National University, Uzhhorod, Ukraine

SUMMARY

Aim: Improving the quality of diagnosis and treatment orthodontic pathology in patient with temporomandibular joint disorders.

Materials and Methods: Analysis – to determine objectives and study plan; clinical-diagnostic methods that include dental and radiological examination (to establish the clinical diagnosis of patients with temporomandibular disorders), electronic axiography (to determine the features of the movements of the articular heads of the mandible), instrumental study the models of jaws in the articulator (to diagnose the state of functional occlusion), statistical (to calculate averages and assess the probability of the results).

Results: After developed and implemented algorithm total dental rehabilitation we have eliminated functional disorders in the masticatory muscles and temporomandibular joints, completely restored the lost function of the masticatory apparatus.

Conclusions: Creation of occlusal relations, which are harmoniously combined with the function of masticatory muscles and temporomandibular joints, allowed to achieve the long period of remission, absence of the complications and recurrences of the disease in the near and long term. These points became the criterions that improved effectiveness of scientifically based individual treatment of mandibular disorders.

Key words: temporomandibular joint disorders (TMDs), malocclusion, individual treatment management

Słowa kluczowe: zaburzenia skroniowo-żuchwowe (TMD), wada zgryzu, indywidualizacja terapii

Acta Balneol, TOM LXIV, Nr 4(170);2022:348-352

INTRODUCTION

Different types of malocclusion could lead to pathological occlusal relations and play a significant role in the pathogenesis of a temporomandibular disorder (TMD) [1-6]. According to the criteria of the DAI index, 10-11% need mandatory orthodontic care, which should be taken into account when developing and implementing a set of preventive measures and treatment of orthodontic pathology [7]. Pathogenic malocclusion in such patients cause proprioceptive changes, which reflexively lead to tension and spasm of the muscles attached to the lower jaw, which contributes to the development of masticatory muscle disorders.

Prolonged change in kinematic occlusal relationships stimulates a stable effect of the total load vector by compression type, leads to adaptive remodelling of musculoskeletal and bone tissues creating conditions for the progression of adaptation mechanisms and subsequently leads to persistent morphological changes in the structure of the disc, articular surfaces, intra-articular connection of the bilaminar zone, which subsequently leads to a spatial change in the position of the disk [8, 9]. There are persistent changes in muscle tone and biological activity of the masticatory muscles, which leads to pain, noise and other symptoms of temporomandibular disorder in the future [10].

Treatment and rehabilitation of adult patients with TMD associated with orthodontic pathology is a difficult problem due to the lack of diagnostic algorithms to assess the patient's dental apparatus and its relationship with functional occlusion [11, 12].

The sequence of actions or their combinations in the diagnosis and treatment of such patients, especially in adulthood, is insufficiently definite. Adults have been other types of oral pathology join orthodontic pathology, that were not treated in childhood or were not completed, such as: pathology of eruption of third molars, partial loss of teeth, secondary deformities, periodontitis, etc [13, 14].

Therefore, patients with orthodontic and TMD require a specific approach to diagnosis and treatment that would normalize occlusal, muscular, and articular relationships, followed by reconstruction of static and functional occlusion by prosthodontic techniques.

AIM

The aim of the research is improving the quality of management orthodontic pathology in patient with temporomandibular joint disorders.

MATERIALS AND METHODS

Present article is based on thesis with ID number of UDK: 616.314.272-02:616.724]-07-08; the research was executed in department of therapeutic dentistry and orthodontic based on Centre of Dentistry Danylo Halytsky Lviv National Medical University, Ukraine. The study protocol was approved by the Commission on Ethics of Scientific Research, Experimental Developments and Scientific Works of Danylo Halytskyi Lviv National Medical University. Also, a medical consent was filled by each contributor and all procedures were required for treatment plans.

In this observational/case-control clinical study, we have treated 44 patients with orthodontic pathology as the leading cause of dysfunction, including 17 men (38.6%) and 27 women (61.4%), who were examined in detail and treated.

The age of these patients was: men - from 17 to 57 years and women - from 18 to 48 years. The largest number of patients, male and female, was between the ages of 20 and 40-12 men (70.59%) and 19 women (70.37%).

The diagnostic protocol of the examined patients included: production of control models of jaws, orthopantomography, zonography with closed and open mouth, ultrasonography (temporomandibular joint (TMJ), muscles and surrounding soft tissues), cone beam computed tomography and magnetic resonance imaging of the TMJ. Functional study with recording the movements of the articulated axis of the articular heads was performed in a Cadiax Compact (Gamma Dental CADIAX).

Kinematic occlusion relationships were analysed in an individually tuned Artex CR Articulator (Amamm Girrbach). Orthodontic treatment of malocclusion managed with hybrid splints, which allowed to move the teeth while maintaining the centric relation. Photo documentation was performed during diagnostic and treatment, 12-18 month after treated.

RESULTS

Carrying out a diagnostic protocol, we have revealed the features of the manducatory apparatus in adult patients with orthodontic pathology associated with temporomandibular disorders. Thus, in this group of subjects, identical pathologies combined with orthodontic disease are observed in both men and women, in particular, the same combination of orthodontic pathology, masticatory muscle and neck muscle pathology. This combination was found in 3 men (17.65%) and 7 women (25.93%), which is the highest rate. The same combination of two pathologies, orthodontic and masticatory muscles, was found in 2 men (11.77%) and 4 women (14.82%). Among women, mostly identical pathologies were observed, compared with men. Thus, 3 women (14.82%) were diagnosed with 4 types of the same combinations of pathologies: orthodontic pathology, masticatory muscles, neck muscles; in contrast to men, where this combination was found in only 1 patient; 5 identical varieties in the combination of orthodontic pathology, pathology of eruption of the third molars, masticatory muscles, neck muscles, meniscus displacement were diagnosed in 2 women (7.41%), in the combination of orthodontic pathology, meniscus displacement also in 2 women (7, 41%). Among men, 4 identical types of combination pathologies were diagnosed in 2 people (11.76%). A total of 44 combinations of pathology were observed in 44 patients with orthodontic pathology and musculoskeletal dysfunction, which averaged 2.14 pathologies per examinee, of which 17 men had 34 types of pathology (2.0 pathologies per person). and 27 women - 60 types of combined pathology (2.2 pathologies per person). Therefore, this group of patients requires a balanced approach to diagnosis and prediction of the expected outcome of treatment.

Given the different combinations of pathological conditions of the oral cavity in adult patients with orthodontic pathology combined with temporomandibular disorders, the complex of treatment of adult patients with temporomandibular disorders associated with orthodontic pathology included a wide range of treatment protocols which aimed at normalizing muscle and joint function and kinematic occlusal relationships.

Our treatment algorithm depending on orthodontic pathology and TMDs included such treat approaches:

- Therapeutic and surgical training included treatment of caries, its complications, treatment of periodontal pathology with the use of photodynamic therapy [15], removal of teeth III-IV degree of mobility, removal according to the indications of 3 molars (from one to four).
- Occlusal therapy with the involvement of different types of occlusal splints: disconnecting, muscle relaxing, repositioning, distraction, stabilizing.
- Orthodontic treatment with the use of splintline therapy, hybrid orthodontic splints.
- Correction of occlusion by selective grinding of teeth, to create a balanced occlusion and, if necessary, restoration of crowns with composite materials using silicone templates. According to the indications were used veneers, and other prostheses.
- Reconstruction of occlusion, which included prosthetics with fixed structures, as well as, if indicated, the use of cover prostheses with fixation on telescopic crowns.
- Permanent dental splint (occlusal splint), which according to medical indications, or if the patient refuses to continue prosthetic rehabilitation was used for its permanent use (night, day-and-night).

Analysis of the applied methods of treatment in patients of this group shows that only occlusal therapy was used in 20.0% of patients, and only splintline therapy in 12.0%, while the combination of occlusal therapy with subsequent splintline therapy in 52% of patients.

The distribution of patients with orthodontic pathology and masticatory muscle disorders by treatment methods is given in Table 1.

Table 1. The distribution of patients with orthodontic pathology and masticatory muscle disorders by treatment methods

Treatment methods	Men		Women		Together	
	N	%	N	%	N	%
	8	**32.0**	**17**	**68.0**	**25**	**100.0**
Occlusal therapy	2	8.0	3	12.0	5	20.0
Splintline therapy	0	0.0	3	12.0	3	12.0
Occlusal therapy + splintline therapy	4	16.0	9	36.0	13	52.0
Occlusal therapy + prostheses	1	4.0	1	4.0	2	8.0
Occlusal therapy + splintline therapy + prostheses	1	4.0	1	4.0	2	8.0

Note. Interest is calculated from the survey group.

Table 2. Distribution of patients with orthodontic pathology combined with joint and combined disorders by treatment methods

Treatment methods	Men		Women		Together	
	N	%	N	%	N	%
	9	**47.4**	**10**	**52.6**	**19**	**100.0**
Occlusal therapy	2	10.5	3	15.8	5	26.3
Splintline therapy	0	0.0	1	5.3	1	5.3
Occlusal therapy + splintline therapy	4	21.1	5	26.3	9	47.4
Occlusal therapy + splintline therapy + prostheses	0	0.0	1	5.3	1	5.3
Occlusal therapy + telescopic copings	1	5.3	0	0.0	1	5.3
Occlusal therapy + permanent dental splint	2	10.5	0	0.0	2	10.5

Note. Interest is calculated from the survey group.

There is important to combine the treatment of temporomandibular disorders with the simultaneous elimination of orthodontic pathology in patients of this group.

Splintline therapy was aimed at normalizing static and dynamic occlusion and function of the temporomandibular joint in the central ratio of the jaws.

Orthodontic treatment with the use of "splintline therapy" consisted in the use of a series of orthodontic splints (Clear Alginer Protocol [16]), made of transparent thermoplastic material, according to the projected plan made in the articulator adjusted to individual function. The articulator was programmed using the upper jaw topography register (AmmanGirrbach external facial arch) and the central jaw ratio register, reproducing dynamic occlusion with different movements, taking into account the physiological position of the temporomandibular joints. The series of orthodontic splints consists of three items, each of which is designed for 7 days of use and has a specified displacement of 0.33 mm. Splints were fixed due to a tight fit in shape to most of the dentition, the rest of the teeth were subjected to the predicted movement in the desired direction.

Most of the teeth on the model with the initial situation were left unchanged for the purpose of stable fixation, and the other teeth (smaller part) were given the predicted movement due to fix on the model heat-resistant wax to ensure a predicted movement. Splints were made by thermoplastic vacuum stamping.

After using each series of splints, as a result of which the selected tooth or group of teeth was predictably shifted by 1 mm, the patient visited the doctor for complete removal of accurate impressions of the upper and lower jaws, which were monitored and corrected. The number of items of orthodontic splints depended on the degree of deformation of the patient's dentition.

In the presence of pain for orthodontic correction of occlusion used hybrid splints, which allowed to move the teeth while maintaining the central ratio of the jaws. Correction of hybrid splints was performed after each stage of tooth movement.

As a result of the application of splintline therapy, the predicted dynamics of changes in the position of a single tooth or a group of teeth with correction or correction of dentition deformation was achieved.

The distribution of patients with orthodontic pathology and with combined temporomandibular disorders by treatment methods is given in Table 2.

These data have showed that only occlusal therapy was performed in 26.3% of patients, and only splintline therapy – in 5.3%, while occlusal therapy followed by splintline therapy – in 47.4% of cases.

Table 3. Treatment measures are applied in the examined patients

Treatment methods	Men		Women		Together	
	n	%	n	%	n	%
	17	**38.6**	**27**	**61.4**	**44**	**100.0**
Occlusal therapy	16	36.4	22	50.0	38	86.4
Splintline therapy	9	20.5	18	40.9	27	61.4
Permanent dental splint	2	4.6	0	0.0	2	4.6
Prostheses	2	4.6	3	6.8	5	11.4
Telescopic copings	1	2.3	0	0.0	1	2.3

Note. Interest is calculated from the survey group.

In the Table 3 presents generalized therapeutic measures used in the treatment of patients.

As can be seen from the Table 3 there were used occlusive therapy using, according to the indications, different types of splints in 38 (86.4%) patients, and the method described above (splintline therapy) was used in 27 (61.4%) patients.

This is due to the fact that quite often, to normalize the muscle and joint relationship, treatment began with one of the options of occlusal splints, and then, when positive results were achieved, switched to splintline therapy or the use of hybrid orthodontic splints.

DISCUSSION

Temporo-mandibular problems are frequently occurring disorders with 45 to 70% of the general population showing some signs of it, 30% being aware of its presence, but only 3 to 12 % seeking treatment for it [12].

The presence of temporo-mandibular disorders on the background of orthodontic pathology in adult patients requires the use of modern diagnostic methods for treatment planning aimed at the simultaneous normalization of both the musculoskeletal complex and the treatment of orthodontic pathology. In patients of this group it is important to combine the treatment of temporo mandibular disorders with the simultaneous elimination of orthodontic pathology. The authors [13] verified that the most individuals (54,5%) with orthodontic pathology presented a mild TMG problems, 17,9% showed moderate TMG problems and 2,6% had a severe TMG problems.

We found that among 175 patients with musculoskeletal dysfunction who asked for treatment after a detailed examination orthodontic pathology was diagnosed in 44 persons (24.14%): 17 men (38.6%) and 37 women (61.4%). Analysis of the applied methods of treatment in patients of this group shows that only occlusal therapy was used in 20.0% of patients, and only splintline therapy in 12.0%, while the combination of occlusal therapy with subsequent splintline therapy – in 52% of patients.

The results of our data indicate that in the case of orthodontic pathology, which is accompanied by musculoskeletal dysfunction in adult patients, to normalize the musculoskeletal relationship, it is advisable to start treatment with one of the options of occlusal splints, and then, when positive results are achieved, to continue treatment with splintline therapy or to the use of hybrid orthodontic splints.

In most cases, the use of distraction-repositioning splint complaints (pain and crunch in the joint during opening the mouth and chewing) decreased in two weeks after treatment and stopped after 2 months, mouth opening increased up to 3.5 mm.

After provided treatment Pain and crunch in the joint when opening the mouth and chewing decreased two weeks after treatment and stopped after 2 months, mouth opening increased to 3.5 mm.

After 2 months, after re-analysis of the functional occlusion in the individually adjusted articulator, the occlusal tire was repaired with an increase in distraction by 1.5 mm. Dynamic monitoring of functional occlusion, as well as clinical manifestations of the disease was performed once a month. After 6 months of treatment, no complaints, the mouth opens 42 mm.

CONCLUSIONS

The presence of temporomandibular disorders associated with orthodontic pathology in adult patients requires their careful examination using modern methods of diagnosis and treatment aimed at the simultaneous normalization of both the muscle and joints complex and the treatment of malocclusion.

References

1. Rybert YuO. Effectiveness analysis of the treatment of patients with articular temporomandibular disorders. Clin Dent. 2016;3:39-44. (in Ukranian)
2. Rybert YuO. Analysis of dentofacial complex of patients with combined temporomandibular joint disorders and treatment approaches. Ukrain Dent Alman. 2016;2(1):68-71. (in Ukranian)
3. Makeev VF, Rybert YuO, Labunets VA et al. Occlusive risk factors for the development of musculoskeletal dysfunction of the temporomandibular joints. Bulletin Dent. 2021;115(2): 85-93. (in Ukranian)
4. Bianchi J, Pinto ADS, Ignácio J et al. Effect of temporomandibular joint articular disc repositioning on anterior open-bite malocclusion: an orthodontic-surgical approach. Am J Orthod Dentofacial Orthop. 2017;152(6):848-858. doi: 10.1016/j.ajodo.2016.09.032.
5. Ferri J, Potier J, Maes JM et al. Temporomandibular joint arthritis: Clinical, orthodontic, orthopaedic and surgical approaches. Int Orthod. 2018;16(3):545-561. doi: 10.1016/j.ortho.2018.06.019.

6. Lyakhova NA. Analysis of risk factors of orthodontic pathology: literature review. Wiad Lek. 2018;71(5):1084-1088.
7. Potapchuk AM, Melnik VS, Gorzov LF, Almashi VM. Prevalence and structure of dental anomalies in children of contaminated areas of the Upper Potyssia ecosystem. Modern Dent. 2019; 2:50-55.
8. Gorucu-Coskuner H, Ciger S. Computed tomography assessment of temporomandibular joint position and dimensions in patients with class II division 1 and division 2 malocclusions. J Clin Exp Dent. 2017;9(3):e417-e423. doi: 10.4317/jced.53524.
9. Martins E, Silva JC, Pires CA et al. Coronal joint spaces of the Temporomandibular joint: Systematic review and meta-analysis. J Clin Exp Dent. 2015;7(3):e435-40. doi: 10.4317/jced.52439.
10. Haghigaht A, Davoudi A, Rybalov O, Hatami A. Condylar distances in hypermobile temporomandibular joints of patients with excessive mouth openings by using computed tomography. J Clin Exp Dent. 2014;6(5):e509-13. doi: 10.4317/jced.51562.
11. Mitsui SN, Yasue A, Kuroda S, Tanaka E. Long-term stability of conservative orthodontic treatment in a patient with temporomandibular joint disorder. J Orthod Sci. 2016;5(3):104-8. doi: 10.4103/2278-0203.186168.
12. Piancino MG, Roberi L, Frongia G et al. Computerized axiography in TMD patients before and after therapy with 'function generating bites'. J Oral Rehabil. 2008;35(2):88-94. doi: 10.1111/j.1365-2842.2007.01815.x.
13. Christensen L, Luther F. Adults seeking orthodontic treatment: expectations, periodontal and TMD issues. Br Dent J. 2015;218(3):111-7. doi: 10.1038/sj.bdj.2015.46.
14. Damasceno YSS, Espinosa DG, Normando D. Is the extraction of third molars a risk factor for the temporomandibular disorders? A systematic review. Clin Oral Investig. 2020;24(10):3325-3334. doi: 10.1007/s00784-020-03277-6.
15. Potapchuk AM, Almashi VM, Lomnitsky IYa et al. The use of photodynamic therapy in the treatment of dental caries in children of contaminated areas of the ecosystem of the upper Tysa region. Wiad Lek. 2020;73(3):483-488.
16. Puts R. Method for correcting deformity of dentition for correcting dental ratio in temporomandibular disorder with the aid of individually matching orthodontic splints. UA. Patent No 79820 MPK A 61 C 7/00 № u 2013 02467; 25.04.13, Bulletin. № 8.

Conflict of interest:
The Authors declare no conflict of interest

Received: 09.02.2022
Accepted: 16.07.2022

ADDRESS FOR CORRESPONDENCE:
Vasyl Almashi
Uzhhorod National University
60a Station St., 88000 Uzhhorod, Ukraine
phone: +380663734736
e-mail: almasi.vaszil@gmail.com

ORCID ID and AUTHORS CONTRIBUTION
0000-0003-4417-9252 – Yuriy Rybert (A, B, C)
0000-0001-9857-1407 – Anatoliy Potapchuk (D, E)
0000-0002-1631-478X – Lidiia Minko (A, B, C, D)
0000-0003-3814-255X – Nataliya Magera (B, C, D, E)
0000-0002-58469165 – Yaryna Semchyshyn (C, E)
0000-0001-5042-0052 – Maksym Dubas (C, E)
0000-0002-2943-4844 – Vasyl Almashi (E)

A – Research concept and design, B – Collection and/or assembly of data,C – Data analysis and interpretation, D – Writing the article, E – Critical review of the article, F – Final approval of article