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INTERDISCIPLINARY ALGORITHM FOR DIAGNOSTIC AND THERAPEUTIC CARE OF PATIENTS WITH INTERMAXILLARY POSITION DISORDERS IN STOMATOGNATHIC SYSTEM DYSFUNCTION

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This article presents the development and implementation of an interdisciplinary diagnostic and therapeutic algorithm for patients with temporomandibular disorders (TMDs) associated with altered maxillomandibular position (MP). An innovative clinical-instrumental workflow, including the Centric Guide® system and the T-Scan III digital occlusal analysis, was used to assess functional asymmetries and deviations in mandibular positioning. A clinical case of a patient with asymmetric MP displacement and associated temporomandibular and masticatory muscle dysfunctions is presented. The treatment protocol involved splint therapy in a registered functional mandibular position (FMP), with significant clinical improvement in pain and occlusal parameters. The results confirm the effectiveness of a structured interdisciplinary approach in diagnosing and treating TMDs.

Key words: *interdisciplinary algorithm,dysfunction of the stomatognatic system, maxillomandibular position, innovative digital guide technology Centric Guide®, T-Scan III, splint therapy.*

Introduction. A relevant direction in modern dental care is the structural and functional rehabilitation of the stomatognathic system (SGS) in patients (Mehl A., 2018; Peroz I., 2024; Vovk V.Yu. et al., 2025). One of its key components is the assessment of the physiological condition of the reflex mechanisms of the central nervous system (CNS), which controls the coordinated function of the temporomandibular joints (TMJs), masticatory muscles, and dental occlusal contacts (Uhliar I.M., 2013; de Moraes Melo Neto C.L. et al., 2021; Kapos F.P. et al., 2020; Türp J.C., Schindler H.J., 2020). Disturbances in maxillomandibular relationships alter the adapted activity of CNS structures, leading to functional disorders of the SGS and triggering its dysfunction (Hlushko T.R., 2022; Vovk Yu.V., Hlushko T.R., 2020; Hlushko T.R. et al., 2021).A practical solution for restoring the maxillomandibular position (MP) lies in the targeted application of modern digital dental technologies (Edelhoff D. et al., 2019; Lo Russo L. et al., 2020; Vovk Y., Vovk V., 2021; Alkhutari A.S. et al., 2021; Vovk V.Yu. et al., 2024) within coordinated interdisciplinary collaboration between dentists and dental technicians to restore the physiological function of the SGS under adequate CNS control (Kandasamy S. et al., 2018; Wagner Ch., 2020; Vovk Yu.V. et al., 2020; Palkov T.A., 2021; Hlushko T.R. et al., 2022).

Interdisciplinary structural and functional dental diagnostics enable the detection of SGS dysfunctions in patients and allow for correction of occlusal contacts of teeth and prosthetic constructions in the restored functional maxillomandibular position (FMP). This approach ensures not only therapeutic outcomes but also prevention of stomatognathic dysfunction (Vovk V.Yu., Vovk Yu.V., 2024; Vovk V. et al., 2024; Vovk V.Yu. et al., 2025).The aim of this publication is to demonstrate the results of our clinical practice in diagnosing and treating maxillomandibular disturbances in patients with SGS dysfunction, based on identifying the types of MP shifts using the innovative Centric Guide® digital pin system developed by Theratecc GmbH & Co. KG, Chemnitz (Germany).

The aim of this publication is to demonstrate the results of our practical work in the diagnosis and treatment of stomatognathic system disorders based on the determination of types of mandibular position (MP) changes using the innovative digital centric stop technology – Centric Guide®, developed by Theratecc GmbH & Co. KG, Chemnitz, Germany.

Subjects and Methods. Fifty-five patients (34 females and 21 males) aged 44 ± 27.5 years with partial and complete tooth loss and suspected stomatognathic system dysfunction involving mandibular position disorders were examined and treated. All patients underwent a clinical functional express analysis of the stomatognathic system according to the methodology of Prof. Meyer G., 2015.

Table 1

Express analysis of clinical diagnostic indicators of stomatognathic system disorders and dysfunction in patients

Клінічна структурно-функціональна діагностика дисфункції СГС
КЛІНІЧНІ
1. Відриття рота обмежене у фронтальному і бічних секторах зубних рядів
2. Відкриття рота асиметричне
3. Сторонні звуки при рухах суглобів (з/без появи больової симптоматики)
4. Встановлення клінічних симптомів порушень жувальних м'язів при пальпації (m.masseter, m.temporalis, супрагіоїдні м'язи) та при їх резистентності на спротив(m.pterygoideus med.&lat.)
5. Центрична оклюзія відсутня (у статичному контакті зубів-антагоністів максимальна інтеркуспідація не відповідає положенню цих зубів у центрованому співвідношенню)
6. Оклюзія при протрузії-ретрузії (стерті поверхні контактуючих різців) та латеротрузіях травматична (стерті поверхні ікол_

The innovative concept for diagnosing mandibular displacement combines clinical and instrumental examination of patients, determining the magnitude and direction of vertical markings displacement on both sides of the upper and lower dental arches between the buccal surfaces of the first molars and the central upper and lower incisors in the habitual mandibular position (HMP), and comparing these with the position defined by the innovative technology as the functional mandibular position (FMP).

To achieve this, plaster models of the upper and lower dental arches were transferred in the laboratory with the aid of a facebow to an analog (Reference, Gamma, Austria) or digital articulator. Markings were applied in the indicated intermaxillary positioning areas on both sides between the first molars and central incisors (Fig. 1).

Fig. 1. Markings between the upper and lower central incisors and buccal surfaces of the first molars on the right and left sides of the lower dental arch in habitual mandibular position.

Using the digital centric stop technology, the individualized FMP was determined and fixed with registration material (PrestigeBite, Vannini Dental Industry, Italy), followed by repositioning the lower jaw model in the articulator according to the obtained registration.In the FMP, the direction and magnitude of displacement of the markings between the specified teeth were assessed in comparison with the habitual position. Identical displacement directions of the first molar markings on both sides of the dental arches indicated symmetrical mandibular displacement either ventrally or dorsally (Fig. 2). Patients with symmetrical mandibular displacements clinically exhibited signs of initial stomatognathic system functional disorders.

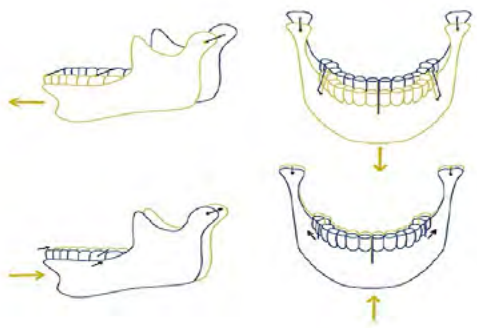

Fig. 2. Schematic illustration of markings showing symmetrical ventral (top) and dorsal (bottom) displacements from the habitual intermaxillary position to the functional mandibular position.

In cases of divergent displacement vectors of the first molars and central incisors markings on both sides of the dental arches, an asymmetrical mandibular displacement was registered, directed ventro-medially or dorso-laterally (Fig. 3). Patients with asymmetrical mandibular displacements demonstrated clinical signs of stomatognathic system dysfunction.

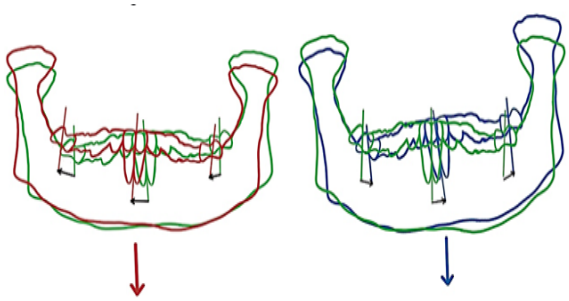

Fig. 3. Asymmetrical positioning of markings during displacement from habitual mandibular position to FMP (left – ventro-medial mandibular displacement; right – dorso-lateral mandibular displacement)

Refined determination of the magnitude and axial displacement of the mandible was established after digitizing the individualized jaw relations of patients in the virtual environment Exocad (Germany) (Fig. 4).

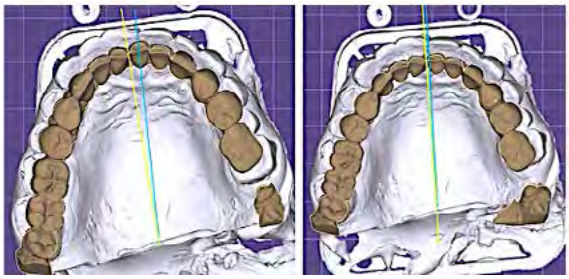

Fig. 4. Refinement of spatial mandibular position on digitized models with analysis of axial displacement in the axial projection.

Results. The study group included patients with asymmetrical mandibular position (MP) displacement associated with stomatognathic system (SGS) dysfunction. Clinically, in patients with asymmetrical deviations of the markings of the posterior and anterior teeth of the upper and lower jaws, lateral-trusive movements revealed canine or group guidance with interferences on the balancing side, protrusive guidance disorders with excessive amplitude of retrusive movements, and the presence of mandibular joint and masticatory muscle dyskinesias.

The clinical-instrumental diagnostic process for this group was supplemented by additional examinations, including panoramic radiography, 3D cone-beam computed tomography (CBCT) or MRI of the joints with the mouth closed and open, condylometry using the A-CPM device (Gamma Dental, Austria), and digital occlusion analysis using the T-scan III device (Tekscan, USA).These additional clinical-instrumental indicators

helped to refine and complement the diagnostic data on mandibular position in patients, ranging from initial signs to pronounced symptoms of SGS dysfunction. The final clinical-instrumental examination scheme for patients with mandibular position disorders and suspected SGS dysfunction is presented in Table 2.

Table 2

Clinical-instrumental examination of patients with mandibular position disorders in SGS dysfunction

Клінічна структурно-функціональна діагностика дисфункції СГС
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ІНСТРУМЕНТАЛЬНІ
7. Симетричність (СМП) / асиметричність (АМП) зміщення МП
ЗРАЗОК ЗАКЛЮЧНОГО ДІАГНОЗУ
Дисфункція стоматогнатичної системи із асиметричним міжщелеповим положенням

Exclusion criteria included patients with traumatic SGS injuries, congenital defects and deformities of the maxillofacial region, psychosomatic disorders, occlusal neuroses, and occlusal dysesthesia.

We present a clinical case in which the innovative diagnostic method and interdisciplinary treatment approach were applied.

At the time of admission, the patient L.O., 17 years old, complained of pain in the right side of the face. The pain appeared in the morning and subsided during the first half of the day.

Dental history: congenital agenesis of tooth 47 (Fig. 5); Prior orthodontic treatment for two years; Composite local restorations on 36 occlusal, 27 occlusal, 46 occlusal, 13, 14 distal, 23, 24 distal.

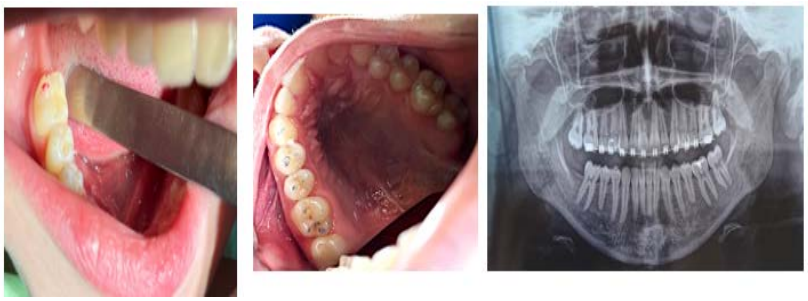

Fig. 5. Clinical and radiological findings of the patient at admission.

Biomechanical and kinematic overload:

- Distal bite;
- Absence of antagonist for tooth 17 due to congenital agenesis of 47;
- Presence of dentoalveolar deformation of 17–47 with recession formation on 17.

Functional status of the stomatognathic system:

- Moderate pain response to palpation of the right anterior temporal and lateral pterygoid muscles;
- Joint sounds in the right temporomandibular joint (TMJ) during mouth opening, closing, and protrusion;

• Normal chewing cycle profile with vertical contacts at rest, excessive expression on all cusps of teeth 17, 16–46 and 27, 26, 25 and 24 to 37, 36, 35;

• Occlusal dysfunction with instability of maximal cusp-fossa contact positions and presence of interferences during protrusion and mediotrusion; lateral-trusive movement on both sides accompanied by group guidance.

Diagnostic conclusion:

• According to the patient, initial pain symptoms appeared after orthodontic treatment and worsened during university preparation;

• Pain was not effectively relieved by analgesics and prescribed nonsteroidal anti-inflammatory drugs;

• Temporary SGS deprogramming with an NTI-tss splint (Glidewell, USA) resulted only in a short-term positive effect;

• Presence of joint sounds in both right and left TMJs with loss of physiological joint-disc relationship and dorsal displacement of both joints (Fig. 6).

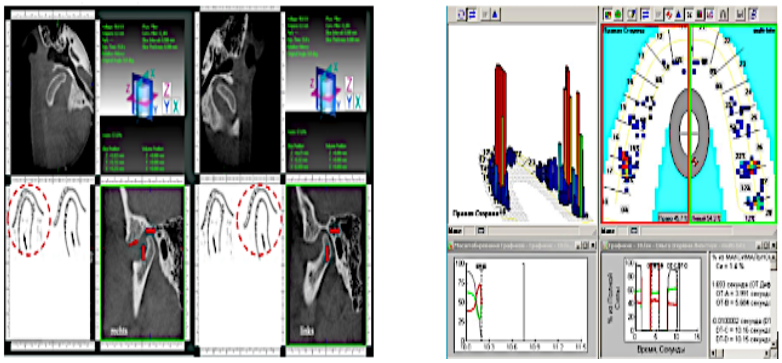

Fig. 6. On 3D CT (left), dorsal displacement of both TMJs is observed; on the right, digital static occlusion analysis shows excessive posterior tooth contact on both sides and disproportionate loading on dental arches (right 45.7%, left 54.3%)

Note: Initial contact in FMP is located in the posterior teeth area 24–34 (Fig. 7).

Fig. 7. Registration protocol recorded with the innovative digital centric stop technology of gothic arch and FMP; plaster jaw models positioned in the articulator in registered FMP corresponding to asymmetric MP displacement. Condylometry (right) using the A-CPM device shows centering of the rotational axes of both TMJs in FMP

Based on the clinical-instrumental findings, the diagnosis of painful stomatognathic system dysfunction with asymmetric FMP displacement was established.

Treatment goals and objectives include control of pain symptoms during SGS dysfunction elimination by reprogramming and harmonizing coordinated masticatory muscle activity, elimination of dyskinesias, restoration of positional reflexes with gradual achievement of a complementary physiological position of the TMJ disc and articular surfaces, achieving stable static and dynamic occlusion, and enabling remodeling of joint surfaces.

The proposed interdisciplinary treatment method involved sequential use of repositioning-stabilizing splint therapy with removable fixation of the splint on the lower jaw teeth (Fig. 8), splinting all lower jaw teeth in a single block fixed in the digital centric stop FMP position with achievement of individualized centric relation.

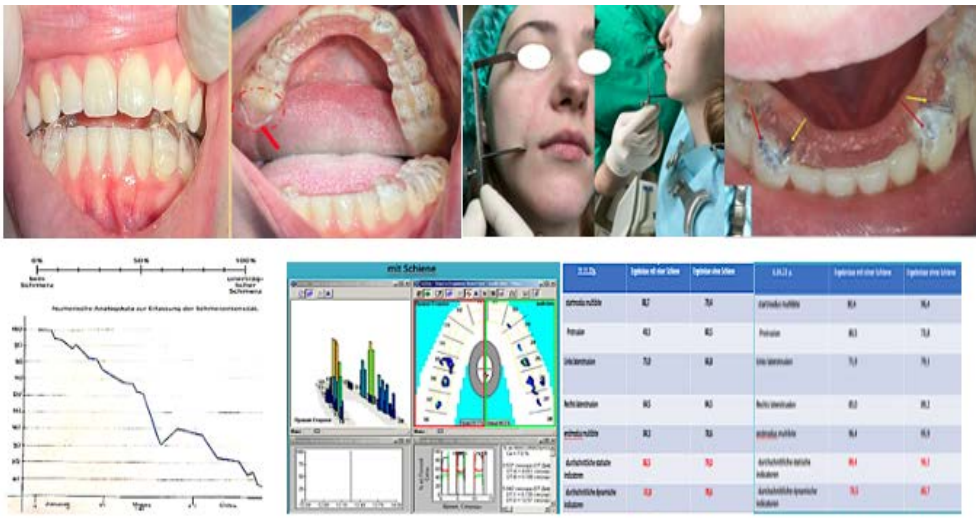

Fig. 8. Top: Intraoral repositioning in FMP using a digitally fabricated splint restoring vertical occlusal height and excursion-incursive movements of the mandible within physiological range. Bottom: Patient's daily pain scale dynamics demonstrating almost complete elimination of pain symptoms during splint therapy. Digital occlusion indicators from the T-Scan III device show balanced values of centered static contacts with harmonious occlusal force balance (right 51.7%, left 48.3%). Positive dynamics in restoration of dynamic occlusion parameters indicate recovery of physiological SGS state.

To restore the integrity of the lower dental arch in the absence of tooth 47, recover symmetry of inter-maxillary position, and eliminate occlusal causes of SGS dysfunction, surgical treatment was performed on 20.02.2025 involving dental implantation (DI) (bluesky, Bredent, Germany) according to a planned digital surgical template (ProDigiDent Lab, Ukraine). Implant uncovering was performed on 19.06.2025. Secondary implant stability was assessed using an implantometer (Osstell, Sweden) showing high values in bucco-lingual (BL) direction – 81 ISQ units and mesio-distal (MD) direction – 82 ISQ units (Fig. 9). Fabrication of a ceramic crown on implant 47 in the re-registered FMP position is planned.

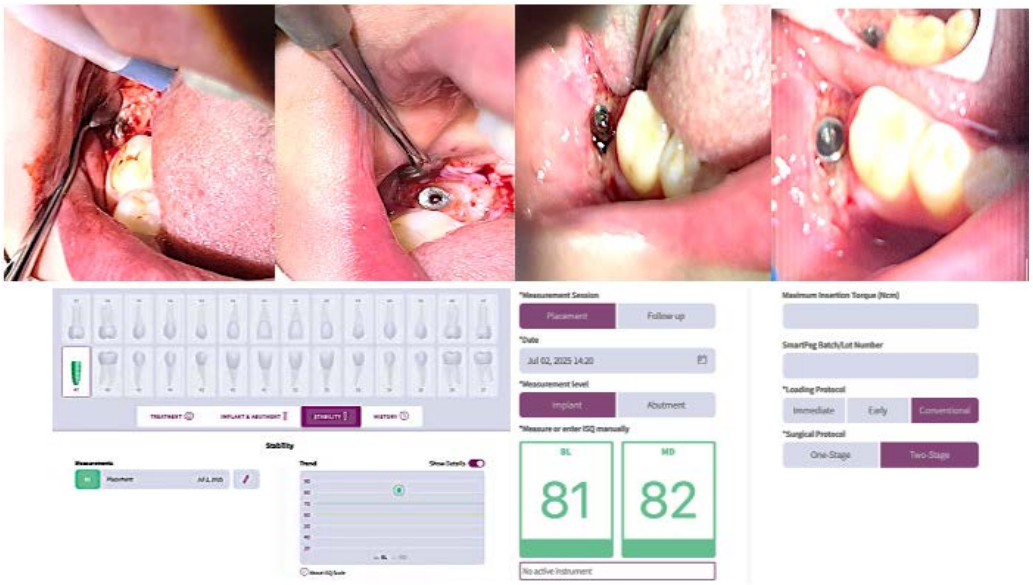

Fig. 9. Application of dental implantation for correction of terminal dental arch defect 47 with crown prosthesis. Left to right: implant uncovering, osteotomy and bone osteoplasty above implant cover screw, removal of cover screw and attachment of resonance frequency analysis sensor for implant stability, sensor removal and fixation of healing abutment with peri-implant soft tissue plastic surgery, secondary implant stability values for implant 47 – 81 ISQ BL and 82 ISQ MD

Discussion and Conclusions:

1. Interdisciplinary collaboration between dentists and dental technicians in both analog and digital domains facilitates the precise practical implementation of a structural-functional algorithm for diagnosing mandibular position (MP) disorders in patients with stomatognathic system (SGS) dysfunction, enabling improvement of practical recommendations for clinical-instrumental examination and the application of consistently effective dental treatment.

2. Complementary to the diagnostic component of the interdisciplinary concept for diagnosis and treatment of patients with MP disorders in SGS dysfunction is the clinical functional diagnosis combined with the analog-digital innovative technology of the digital centric stop Centric Guide®, developed by Theratecc GmbH & Co. KG, Chemnitz, Germany.

3. When determining types of MP displacements, it is advisable first to clinically assess the severity of SGS dysfunctions in patients, followed by transferring the mandibular positioning to plaster models of the dental arches in an articulator or virtual environment. By comparing these, one can identify symmetry or asymmetry of displacement from the habitual MP to the established functional mandibular position (FMP).

4. The study of additional indicators of clinical-instrumental examination (position of joint heads on 3D CT; occlusal contact time and disocclusion time; balance of occlusal force in dental arches and total masticatory muscle activity parameter using digital T-Scan III occlusion analysis; centering of the temporomandibular joint hinge axis using the A-CPM condylometer) in patients with asymmetric MP disorders will clarify and complement diagnostic information on the development of SGS dysfunction, allowing for more precise monitoring during interdisciplinary treatment.

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МІЖДИСЦИПЛІНАРНИЙ АЛГОРИТМ ДІАГНОСТИЧНО-ЛІКУВАЛЬНОЇ ДОПОМОГИ ХВОРИМ З ПОРУШЕННЯМИ МІЖЩЕЛЕПОВОГО ПОЛОЖЕННЯ ПРИ ДИСФУНКЦІЇ СТОМАТОГНАТИЧНОЇ СИСТЕМИ

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Статтю присвячено розробці та впровадженню міждисциплінарного алгоритму діагностично-лікувальної допомоги хворим із дисфункцією стоматогнатичної системи на підставі оцінки та клінічно-інструментального визначення зміщення міжщелепового положення (далі – МП). Застосовано інноваційну цифрову технологію Centric Guide® та T-scan III у комплексі з клінічною оцінкою. Описано випадок лікування пацієнтки з асиметричним середнім зміщенням МП, дискінезіями суглобів та жувальної м'язової системи. Результати лікування засвідчують високу дієвість міждисциплінарного підходу.

Ключові слова: *міждисциплінарний алгоритм, дисфункція стоматогнатичної системи, міжщелепове положення, інноваційна цифрова технологія Centric Guide®, T-scan III, сплінт-терапія.*