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CORRELATION OF TEMPOROMANDIBULAR JOINT CHANGES IN REPRODUCTIVE-AGE FEMALE PATIENTS ACCORDING TO THE PATHOGENETIC CLASSIFICATION

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The study addresses the relationship between gynecological factors and the progression of osteoarthritis of the temporomandibular joint, focusing on pathogenesis-based classification of intra-articular temporomandibular joint disorders. The research involved analyzing clinical and hormonal data from female patients, emphasizing the impact of reproductive health on temporomandibular joint pathology. The findings revealed a significant correlation between specific gynecological conditions and the severity of temporomandibular joint osteoarthritis, highlighting the importance of considering reproductive health in the management and diagnosis of temporomandibular joint disorders. This study contributes to global science by proposing a novel perspective on the interconnection between gynecological factors and temporomandibular joint pathology, which could influence future diagnostic and therapeutic approaches.

Key words: temporomandibular joint, osteoarthritis, pathogenesis, reproductive health, temporomandibular joint disorders.

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КОРЕЛЯЦІЙНИЙ ЗВ'ЯЗОК ЗМІН СКРОНЕВО-НИЖНЬОЩЕЛЕПНОГО СУГЛОБУ У ПАЦІЄНТОК РЕПРОДУКТИВНОГО ВІКУ ЗГІДНО ПАТОГЕНЕТИЧНОЇ КЛАСИФІКАЦІЇ

Дослідження розглядає взаємозв’язок між гінекологічними факторами та прогресуванням остеоартрозу скронево-нижньощелепного суглобу, зосереджуючись на класифікації внутрішньосуглобових порушень скронево-нижньощелепного суглоба за патогенезом. Дослідження включало аналіз клінічних і гормональних даних пацієнток на етапі репродуктивного періоду життя, які мали патологію скронево-нижньощелепного суглоба. Результати виявили значну кореляцію між конкретними гінекологічними захворюваннями та тяжкістю остеоартрозу скронево-нижньощелепного суглоба, підкреслюючи важливість урахування репродуктивного здоров’я при лікуванні та діагностиці розладів скронево-нижньощелепного суглоба. Це дослідження робить внесок у світову науку, пропонуючи новий погляд на взаємозв’язок між гінекологічними факторами та патологією скронево-нижньощелепного суглоба, що може вплинути на майбутні діагностичні та терапевтичні підходи.

Ключові слова: скронево-нижньощелепний суглоб, остеоартроз, патогенез, репродуктивне здоров’я, ураження скронево-нижньощелепного суглоба.

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A feature of temporomandibular joint dysfunction (TMJD), according to research, is a significant prevalence of this disease among women [4].

Puberty in women is accompanied by a series of events related to the menstrual cycle and hormones affecting the musculoskeletal system. Hormonal changes in the body of women can lead to knee laxity in most women, increase the risk of developing an imbalance between the hamstring and quadriceps muscles [2], and lead to changes in bone tissue, which depends on the menstrual cycle [1]. That is why, studies of the imbalance of neuromuscular connections between components of the dento-facial region are important for [9] current diagnostic research.

There are many valid classifications of temporomandibular joint pathologies widely used by the scientific community. In particular, the classification by C. H. Wilkes , in our opinion, is the most relevant for clarifying intra-articular disorders, but it is not always suitable for certain clinical cases.

The purpose of the study was to investigate the influence of gynecological and hormonal factors on the development of temporomandibular joint osteoarthritis, taking into account the sexual predisposition to this disease.

Materials and methods. This study complies with the Rules of Humane Treatment of Patients in accordance with the requirements of the World Medical Association Declaration of Tokyo. International recommendations of the Helsinki Declaration on Human Rights, the Convention on Human Rights and Biomedicine of the Council of Europe. The laws of Ukraine, the orders of the Ministry of Health of Ukraine and the requirements of the Code of Ethics of a doctor of Ukraine.

To ensure the reliability of the correlation between the condition of the temporomandibular joint and gynecological status in women, inclusion and exclusion criteria were formed.

Inclusion criteria:

– Female patients of reproductive age diagnosed with TMJD who completed the examination protocol: questionnaire and MRI.

Exclusion criteria:

– Men and women of menopausal age.

– Presence of other concomitant diseases of the body.

– Patients with articulation-occlusion disorders of the dentition (dentition defects), psychosomatic disorders (neurotic, dysmorphophobic, etc.), muscle coordination disorders of the masticatory muscles, and persistent kinematic displacements of the mandible were also excluded from the study.

At the Department of Propaedeutics of Oral Surgery of the Poltava State Medical University out of 169 women, 49 women of reproductive age from 15 to 51 years were selected for correlation analysis. All patients gave informed consent to participate in the study.

Anamnesis was collected according to the generally accepted methodology and included an additional questionnaire. The questions were aimed at detailed clarification of gynecological and hormonal anamnesis.

Among the data from the completed questionnaires, we identified the following parameters: hysterectomy, breast cancer, ovariectomy, number of births, number of abortions, number of miscarriages, thyroid gland (TG) cyst, ovarian cyst, use of hormonal contraceptives, elevated prolactin level in the blood, history of hypothyroidism, history of autoimmune thyroiditis, mastopathy, rheumatoid arthritis, and uterine fibromatosis.

All patients underwent magnetic resonance imaging (MRI) using the Siemens Magnetom Avanto device with a magnetic field strength of 1.5 T produced by Siemens AG, Germany.

Among the pathologies of the TMJ, the following conditions were selected for statistical processing of the results: temporomandibular joint disc displacement with reduction (DDwR), peculiarities of the position of the right articular disc in dislocations, peculiarities of the position of the left articular disc in dislocations, temporomandibular joint disc displacement with reduction (DsDwR), disk displacement without reduction (DDwoR), disks displacement without reduction (DsDwoR), presence of flattening of both articular heads, flattening of one of the articular heads, deforming arthrosis, bone growths of one joint, degenerative changes in the posterior articular ligaments, asymmetry of the articular heads, hypoplasia of the articular heads, degenerative changes in the disc, severity of TMJD.

The presence of correlation coefficients was checked using the Real Statistics 2019 extension for Microsoft Office Excel by calculating Kendall's tau (τ). Correlation ratios were considered statistically significant at $p<0.05$.

Results of the study and their discussion. We have proposed a classification of intraarticular TMJ disorders by pathogenesis (Table 1).

Table 1

Classification of intra-articular disorders of the TMJ by pathogenesis

<table>
<tr><td colspan="2">Type of TMJ pathology</td><td colspan="3">Meniscus placement options</td><td colspan="2">Category I</td></tr>
<tr><td colspan="2">1</td><td>A</td><td>B</td><td>C</td><td colspan="2">Dislocation of the meniscus. There are no structural changes.</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="8">Anterior partial articular disc dislocation with reduction</td><td rowspan="8">Anterior complete articular disk dislocation with reduction</td><td rowspan="8">Anterior complete articular disk dislocation without reduction</td><td colspan="2">Category II</td></tr>
<tr><td colspan="2">Articular condylar hypoplasia and meniscus dislocation.</td></tr>
<tr><td>3.1</td><td rowspan="2">Mild stage</td><td rowspan="6">OA</td><td>Structural changes in one of the joints.</td></tr>
<tr><td>3.2</td><td>Cartilage or bone structural changes in both joints</td></tr>
<tr><td>4</td><td>Medium stage</td><td>Cartilage and bone structural changes in both joints</td></tr>
<tr><td>5</td><td>Severe stage</td><td>Structural changes in one or both TMJ with the appearance of osteophytes</td></tr>
<tr><td colspan="2">6</td><td colspan="2">Hypoplasia. OA. Dislocation of the meniscus</td></tr>
</table>

Its practical application can help scientists in retrospective studies, in particular to understand the pathogenesis of the disease. It is based on our own clinical experience, literature analysis, and the experience of radiologists.

Based on the differentiation of pathological signs of MRI of the TMJ, we identified two categories of TMJ disease development: dysfunctional and dysfunctional with changes in bone and cartilage structures. Along with the categories, we have identified six types of TMJ pathology. Type 1 – meniscus dislocation. Type 2 – hypoplasia of the condyles. Types 3, 4 and 5 are the stages of OA. Type 6 hypoplasia is complicated by OA. Types 2-6 can be combined with meniscal dislocation.

In their practice, clinicians often divide TMJ diseases into only functional disorders and those that are already accompanied by structural changes in the joint. Thus, dysfunctional disorders of the TMJ can be divided into two main categories:

1. Only dysfunctional changes in the TMJ. Dislocations of the meniscus and its position relative to the articular head.

2. Dysfunctional changes in the TMJ combined with organic disorders. Dislocations of the meniscus and its position relative to the articular head. Damage to the bone elements of the joint: hypoplasia/flattening of the articular head and bone growth (osteophytes). Damage to the cartilage elements of the joint: degenerative changes of the meniscus.

In this classification, it is proposed to make a diagnosis, where in the first part the type of structural changes is from 1 to 6, in the second part the variant of TMJ dysfunction: A, B, C. For example: 4 A, where "4" is the type of structural disorder of the TMJ, "A" is a variant of TMJ dysfunction. If there are no structural changes, the diagnosis will sound like this: 1 A/B/C. If the displacement of the meniscus is anatomically and functionally correct, the diagnosis will sound like this: 1 0 or 2 0 and so on.

Out of 41 patients, 19 had meniscal dislocation, no structural changes – type 1 of TMJ pathology. Three had meniscus dislocation type A, 13 – B, 2 – C.

6 patients had hypoplasia of the condyles in combination with meniscal dislocation – type 2 of TMJ pathology. Four of them had meniscus dislocation type B, one – A.

5 patients had a mild degree of osteoarthritis – type 3.1 of TMJ pathology. Three had meniscus dislocation variant A, and two – B.

3 patients had a mild degree of osteoarthritis – type 3.2 of TMJ pathology. Two had meniscal dislocation variant B, one – C.

6 patients had a moderate degree of osteoarthritis – type 4 of TMJ pathology. Two had meniscal dislocation variant A, three – B, one – C.

Two patients had severe OA – type 5 of TMJ pathology, with A variant of meniscus dislocation.

8 patients had osteoarthritis complicated by hypoplasia of the condyles – type 6 of TMJ pathology. Seven had meniscus dislocation type B, and one had type C (Table 2).

Table 2

Statistically significant correlations between anamnestic data of gynecological health and the presence of TMJ pathologies in women of reproductive age

Gynecological anamnesis data	TMJ pathology	τ	p
Childbirth in the anamnesis	DsDwR	-0.421	0.0023
	DDwR	0.345	0.0126
	DDwoR	0.345	0.0126
	flattening of one of the articular heads	0.276	0.0456
	deforming arthrosis	0.486	0.0004
	severity of TMJD	0.298	0.021
History of abortions	DsDwR	-0.329	0.0209
	DsDwoR	0.398	0.0052
	flattening of one of the articular heads	0.332	0.0196
	deforming arthrosis	0.414	0.0037
	asymmetry of the articular heads	-0.306	0.0319
Cysts of the thyroid gland	flattening of both articular heads	0.328	0.0236
Ovarian cysts	flattening of both articular heads	0.293	0.0423
History of hypothyroidism	flattening of both articular heads	0.328	0.0236
Autoimmune thyroiditis in the anamnesis	DDwR	0.290	0.0446
	DDwoR	0.290	0.0446
	bone growths of one joint	0.290	0.0446
Fibromatosis of the uterus	flattening of one of the articular heads	0.326	0.0238
	deforming arthrosis	0.383	0.079
	degenerative disc changes	0.505	0.0005
	severity of TMJD	0.306	0.0229

The presence of childbirth in the anamnesis has a directly proportional correlation with DDwR, DDwoR, flattening of one of the joint heads, deforming arthrosis and with severity of TMJD. Additionally, the presence of childbirth in the anamnesis shows an inversely proportional correlation with the presence of DsDwR.

Abortions in the anamnesis have a directly proportional correlation with the presence of DsDwoR, flattening of one of the articular heads and deforming arthrosis. Additionally, abortions in the anamnesis show an inversely proportional correlation with the presence of DsDwR-and asymmetry of the articular heads.

Cysts of the ovaries or thyroid gland or hypothyroidism in the anamnesis of a woman of reproductive age show a directly proportional correlation with the presence of flattening of both articular heads.

In the case of autoimmune thyroiditis, directly proportional correlations are noted with the presence of a DDwR, DDwoR, and the presence of bony growths of one joint.

Uterine fibromatosis in the anamnesis has a directly proportional correlation with the flattening of one of the joint heads, the presence of deforming arthrosis, degenerative disc changes and with severity of TMJD.

Organic changes in the TMJ frequently co-occurred among patients in the reproductive period. We were unable to perform a correlation analysis for the postmenopausal patient group due to the significantly smaller sample size and the uniform severity of TMJD, as this group only exhibited stage 4 severity. Therefore, we decided to exclude the postmenopausal group from this study.

According to our observations, 140 patients had a confirmed diagnosis of TMD (according to the ICD10 classification), 76 had a certain pathology of the reproductive system, and 64 did not note any pathologies. Such a high incidence may indicate the connection of joint disorders with gynecological disorders [3].

During the physiological course of pregnancy, changes occur in a woman's body that go far beyond the limits of the female genital organs [4]. Childbirth is a natural result of pregnancy. Even under physiological conditions, childbirth affects the condition of the muscles and fascia of the abdomen and pelvic floor, leading to their thinning, especially under conditions of impaired fibroblast functions [10]. Scientific literature provides data on structural changes in the extracellular matrix of the myometrium during pregnancy and childbirth in mammals and humans, which include remodeling of collagen and elastin [6]. Given the important role of elastin in TMJ functioning, a possible reason for the correlation between childbirth and DDwR/DDwoR is elastin restructuring [8]. Currently, in the scientific literature, there are almost no data on changes in the structure of elastin in the TMJ during pregnancy and in the postpartum period. In experiments on animals, it was shown that the expression of matrix metalloproteinases (MMPs) changes during pregnancy and childbirth, among which MMP-12 is of particular importance for elastin metabolism [12]. Increased expression of MMP-12 is associated with the development of TMJ pathologies [11]. Therefore, a promising direction for further study of the pathogenesis behind the existence of a correlation between childbirth and DDwR/DDwoR is the study of changes in the activity of MMP-12 during pregnancy and in the postpartum period. Changes in MMP activities may also be responsible for the direct correlation between women's history of childbirth and the development of flattening and deforming arthrosis.

The establishment of possible pathogenetic relationships that could determine the presence of statistically significant correlations between abortions in anamnesis and TMJ pathologies is complicated by the limitations of our study. When analyzing the anamnestic data, we established only the presence/absence of abortions and their number, however, there are no important data on the methods of abortion, the periods of pregnancy at which this intervention was performed, and the presence of a previous pregnancy that ended in childbirth.

Thyroid gland cysts and hypothyroidism in a patient have a common link, since in both described conditions, the production of thyroid hormones decreases. Thyroid hormones can regulate the growth and differentiation of chondrocytes and osteocytes [13]. Deficiency of thyroid hormones under conditions of hypothyroidism and replacement of endocrinocytes by a thyroid gland cyst can explain the presence of direct correlations between the presence of these conditions in the anamnesis and the flattening of one of the joint heads. A similar imbalance of hormonal regulation of growth and differentiation of cellular components of bone and cartilage tissue may explain the presence of direct correlations between a history of an ovarian cyst and flattening of one of the articular heads [7].

Combinations of TMJ diseases can cause distortion of the statistical results of the study. Therefore, it was decided to include individual organic changes of the TMJ and to perform statistical processing with

a given classification by the severity of TMJ. The classification was characterized by the progression of TMJ OA, but did not exclude other diseases such as meniscal dislocation and condylar hypoplasia. The statistical study revealed a negative correlation between condylar hypoplasia and gynecological conditions, which explains its development due to another etiopathogenesis.

Our findings corroborate those reported in our earlier preprint, where we identified significant correlations between gynecological health and TMJ pathologies in women of reproductive age [5].

Conclusions

Significant correlations between various gynecological conditions with pathologies of the TMJ, which have not been studied in detail before, have been established:

1. The association of childbirth, abortion, thyroid cysts, ovarian cysts, hypothyroidism, autoimmune thyroiditis and uterine fibroids with organic changes in the TMJ was revealed. In particular, a positive correlation between gynecological conditions is more common with flattening of the joint heads, degenerative changes in menisci and osteophytes.

2. A negative correlation was found with condylar hypoplasia and degenerative changes in the articular ligaments.

3. The positive correlation of biomechanical changes in the form of DDwoR, DDwR and DsDwR can be explained by their combination with concomitant organic changes in the joint, which have a strong correlation.

4. It was found that the severity of TMJD may depend on childbirth and uterine fibroids. This means that the number of births and prolonged high hormone levels during pregnancy, as well as changes in uterine fibroids, can cause the progression of TMJD in the future.

The presence of the aforementioned pathologies in the anamnesis of a woman of reproductive age can serve as a basis for a detailed study of these processes and their impact on the condition of the temporomandibular joint.

We see prospects for further research in the study of pathogenetic cause-and-effect relationships between the studied anamnestic data of gynecological health and TMJ pathologies. Additionally, the determination of correlations between the anamnestic data of gynecological health and TMJ pathologies not covered in our study may be a promising direction of further research.

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