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Clinical evaluation of the effectiveness of electrophoresis with a periodontal gel composition based on a flavonoid complex under the conditions of stress-modulating effect of fixed orthodontic appliances on periodontal tissues

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Introduction. One of the most important biological reactions to orthodontic treatment with braces is oxidative stress, which in patients with periodontal diseases is associated with a number of proinflammatory factors and hypoxia. The development of effective treatment regimens to eliminate the effects of local oxidative stress and the use of adequate prognostic markers for its regulation is an important promising area in the treatment of orthodontic patients with periodontal tissue diseases.

The aim of this study was to evaluate the clinical efficacy of the developed therapeutic and prophylactic complex, which included a modified procedure of gingival electrophoresis in combination with the periodontal gel composition «Benzidaflaziverdine» (GCB), consisting of two active components - flavonoid complex and benzidamine hydrochloride in the treatment of chronic generalized periodontitis(CGP) of initial-I degree of severityin orthodontic patients before and during the active period of orthodontic treatment under conditions of local oxidative stress.

Materials and methods. The subject of this study were 118 patients aged 20-35 years, diagnosed with various types of dentoalveolar anomalies against the background of initial-I stage CGP, divided into two groups. In patients of the main group (60 people), the developed treatment and prophylactic complex with modified gingival electrophoresis and GCB was used before the active period of orthodontic treatment and during its course (3 and 6 months). Patients in the comparison group (58 people) received a traditional treatment regimen, including applications with Cholisal gel, within the same time frame. To assess the effectiveness of the treatment, the BOP, API and GI indices were calculated. The value of lactate dehydrogenase (LDH) in saliva was used as a prognostic marker of local oxidative stress.

Results. The inclusion of the electrophoresis procedure in combination with GCB in the complex of therapeutic and preventive measures before and during the active period of orthodontic treatment in patients of the main group led to a more intensive normalisation of BOP, API, GI and LDH levels. There was a faster improvement in the condition of periodontal tissues which ensured a favourable course of the active period of orthodontic treatment. In the main group, 3 months after the start of orthodontic treatment, there was a minimal increase in the BOP (7.85±3.18%), ARI (11.13±10.12%) and GI (0.07±0.05 points) indices, which indicated a slight destabilisation of the situation, which required only minor correction. At the same time, patients in the comparison group showed an active increase in index parameters – BOP (43.48±23.12%), API (70.64±17.98%) and GI (0.59±0.33 points), which confirmed the loss of remission and required a second course of treatment with a traditional regimen. If after the installation of braces in the main group, the LDH index was within 424.52±103.5 units/l ($p<0.001$), then in the comparison group this led to a sharp increase to 1687.6±240.8 units/l, which to a certain extent exceeded the index of the same comparison group before periodontal treatment (1446.1±441 units/l) and indicated the presence of a significant local stress-modulating reaction and insufficient effectiveness of the traditional treatment regimen.

Conclusions. According to the results of changes in periodontal status and LDH indices in orthodontic patients with CGP, it is possible to note the expediency of using the developed GCB in combination with electrophoresis in the tissues of the periodontal complex before and during active orthodontic treatment. The clinical efficacy of the proposed treatment and prophylactic complex was confirmed by the BOP, API and GI indices. The studies also suggested that the level of LDH is a sensitive marker that reflects the biological activity that occurs in the periodontium in the case of CGP before periodontal treatment and during the first three months of orthodontic movement of teeth. Therefore, this enzyme can be used as a diagnostic tool for monitoring orthodontic treatment in patients with periodontal tissue pathology.

Keywords: orthodontic patients, periodontitis, oxidative stress, treatment, gel composition, flavonoids, electrophoresis, saliva, lactate dehydrogenase.

Relationship of the publication to planned research works

This scientific work is a fragment of the complex research topic of the Department of Orthodontics of Danylo Halytskyi Lviv National Medical University «State of dental health and its correction based on the systematic analysis of clinical, laboratory, radiological, morphological, functional, aesthetic parameters in people of different ages» (state registration number 0120U002143).

Introduction

Over the past decades, the results of studies have shown a consistently high prevalence of dentoalveolar anomalies (DA) (from 23% to 85%) in patients of different ages and wide variability of such data, in particular in Ukraine [1, 2, 3, 4, 5]. At the same time, the number of undiagnosed DA increases with age, and their course is significantly complicated by the involvement of periodontal tissue pathology. Therefore, the planning of orthodontic treatment in adult patients with signs of periodontal diseases requires balanced approaches.

The study of the peculiarities of the processes occurring during the active period of orthodontic treatment using fixed orthodontic appliances is aimed at understanding the conversion of mechanical energy generated by orthodontic forces into biological reactions in the teeth and supporting tissues [6]. During the active period of orthodontic treatment, these forces, which provide the necessary tooth movement, along with the residual chronic inflammatory process and occlusal trauma, negatively affect tissue barriers, causing various side effects, in particular, recurrent inflammatory and dystrophic-inflammatory processes in periodontal tissues with loss of epithelial attachment, periodontal abscesses and progressive destruction of bone tissue of the alveolar processes of the jaws [7, 8, 9].

One of the most important biological reactions to orthodontic treatment with braces is oxidative stress, which in patients with periodontal disease is associated with a number of pro-inflammatory factors and hypoxia. Oxidative stress is defined as a change in the balance between the production of reactive oxygen forms (ROF) (free radicals) and the antioxidant defence system that counteracts them. During orthodontic treatment, various factors that can cause oxidative stress coexist: on the one hand, fixed orthodontic appliances, and on the other hand, the biomechanics of tooth movement, in particular periodontally compromised teeth [10, 11].

A thorough understanding of the cellular and molecular responses to mechanical loading during orthodontic treatment is necessary to achieve tooth movement in a shorter time with fewer side effects for the periodontal tissues. According to the literature, the period of orthodontic treatment with an interval of 3–4 weeks to 3 months can be defined as critical both in terms of stress-modulated reaction and in terms of the maximum level of bacterial contamination of the surfaces of teeth and surrounding tissues [12, 13, 14]. At the same time, the development of effective treatment regimens to eliminate the effects of local oxidative stress and the use of adequate prognostic markers of its regulation is an important promising direction in the treatment of orthodontic patients with periodontal tissue diseases.

Considering all the above, the use of antioxidants and topical non-steroidal drugs in the complex treatment of periodontal pathology in orthodontic patients is pathogenetically justified. Medicines belonging to these groups, under conditions of oxidative stress, inhibit peroxides and intermediate products of free radical oxidation of lipids, have anti-inflammatory, analgesic and anti-edematous effects, and accelerate reparative processes [15]. Therefore, a periodontal gel

composition «Benzidaflaziverdine» (GCB) was developed and patented, consisting of two active components – a flavonoid complex («Proteflazid» drops (SPC Ecopharm LLC, Ukraine) and benzidamine hydrochloride («T-Sept» tablet form (ICN Polfa Rzeszow S.A, Poland) – a non-steroidal anti-inflammatory drug of topical action) on a gel basis (sodium alginate, nipagine and water for injection) [16].

In modern periodontology, a physiotherapeutic method such as electrophoresis remains relevant, the therapeutic effect of which is due to the field of direct electric current on the one hand, and the use of a pathogenetically sound drug on the other. The result is an active stimulation of periodontal tissue microcirculation due to the irritating effect and prolongation of analgesic action.

Thus, ***the aim*** of this study was to evaluate the clinical efficacy of the developed therapeutic and prophylactic complex, which included a modified procedure of gingival electrophoresis in combination with a periodontal gel composition consisting of two active components – flavonoid complex and benzidamine hydrochloride in the treatment of chronic generalised periodontitis of the initial-I degree of severity in orthodontic patients before and during the active period of orthodontic treatment under conditions of local oxidative stress.

Materials and methods

The subject of this study were 118 patients aged 20-35 years, both sexes, diagnosed with various types of DA (combined dental anomalies, dentition with malocclusion) against the background of chronic generalised periodontitis (CGP) of initial-I severity. The main group consisted of 60 patients who received a treatment and prevention complex, including initial periodontal therapy, SRP protocol and modified gingival electrophoresis (GE-5-03 device (SMEP)) using individually made mouthguards with GCB (5–7 procedures every day or every other day). Patients in the comparison group (58 people) received a traditional treatment regimen that included applications with Cholisal gel (Jelfa S.A. Poland) in accordance with the «Protocols of the Ministry of Health of Ukraine» for the provision of medical care in the specialty «Therapeutic dentistry».

The diagnosis of periodontal status in orthodontic patients and the establishment of the diagnosis was carried out according to the classification of M.F. Danilevsky (1994) on the basis of anamnesis and clinical assessment of the state of periodontal tissues [17]. Probing of clinical pockets was performed on 6 surfaces of all teeth with a periodontal probe with a ball on the top, taking into account the depth of probing and the level of clinical attachment. During the study, the data obtained from the periodontal examination were recorded by comparing clinical photographs, diagnostic models and online electronic periodontal charts (periodontalchart-online-com). The condition of the bone tissue of the alveolar processes of the jaws was assessed by the data of targeted and panoramic radiography.

To evaluate the effectiveness of periodontal treatment, the bleeding index BOP (Bleeding on Probing, Ainamo & Bay, 1975), the index of plaque in the interdental spaces API (Approximal Plaque Index, Lange D.E., Plagmann H., 1977) and the Gingival Index (GI, J. Sillness, H. Loe, 1967), which allows to determine the location and severity of gingival inflammation (mild, moderate and severe) in symptomatic gingivitis [18]. The value of lactate dehydrogenase (LDH) level in the oral fluid and blood serum («UNILAB» LLC, Licence of the Ministry of Health of Ukraine Series AG No. 597497 dated 09.02.2012) was used as a prognostic marker of local oxidative stress.

The observation periods in both groups were as follows. The above study parameters were obtained before and after periodontal treatment of initial- and first-degree severity of CGP in patients with DA and immediately before the installation of fixed orthodontic appliances (G&H® miniPrevail® TWIN Bracket System); then – at the 3rd month of the active period of orthodontic treatment and 6 months after the installation of braces.

The research was conducted in strict compliance with generally accepted standards of morality, the requirements for respecting the rights, interests and personal dignity of all participants. There was no risk to the research subjects during the study. The study was conducted in accordance with the principles of bioethics set out in the Declaration of Helsinki «Ethical Principles for Medical Research Involving Human Subjects» and the Universal Declaration on Bioethics and Human Rights (UNESCO). The study participants were informed about all aspects related to the purpose, objectives, methods and expected benefits of the study. No experimental studies on humans were

used. The study protocol No. 9 of 21.12.2020 was discussed and approved by the Ethics Committee for Scientific Research, Experimental Development and Scientific Works of Danylo Halytskyi Lviv National Medical University.

In order to assess the degree of reliability of the results obtained, the data obtained were statistically processed using generally accepted methods of variation statistics: calculation of the arithmetic mean (M), standard deviation (σ) and standard error (m). The degree of reliability (p) of the results was determined using the t-test.

Results of the study and their discussion

In all patients who sought periodontal care before the installation of fixed orthodontic appliances, the examination revealed complaints of bleeding and swelling of the gums, bad breath, and discomfort typical of initial- and first-degree CGP. Completion and analysis of periodontal charts revealed that the average depth of periodontal pockets was 1–3.5 mm. In 40% of patients, the mobility of individual teeth of the first degree was noted. The X-rays in the areas of the anterior teeth and molars showed a mixed situation, since it was particularly difficult to trace the complete loss of the cortical layer or only the disintegration of the tops of the interalveolar septa in 67% of the anterior teeth of patients in both groups due to the crowding of the teeth.

Before periodontal treatment, the indices of BOP, API and GI in patients of both groups did not differ significantly. After the treatment, statistically significant differences were observed in the scores of both groups for all three indices. If the BOP index before treatment in both groups averaged 77.13%, then after the course of electrophoresis with GCB in the main group, this index decreased to 1.83±0.71% ($p<0.001$), in contrast to 10.24±9.60% in the comparison group, whose patients received conventional treatment. Accordingly, in the comparison group, such indicators delayed the installation of fixed orthodontic appliances and led to the prolongation of the treatment course (Table 1).

The mean values of API and GI indices before periodontal treatment in both groups were 77.32% (according to the evaluation scale, this is an unacceptable level of hygiene) and 1.08 points (according to the interpretation of the values, this is an inflammatory process in the gum tissues of mild to moderate severity). Treatment of patients in the main group and the comparison group with different treatment regimens also led to different statistically significant results. In the main group, the API and GI indices were 3.02±2.3% and 0.05±0.04 points, as opposed to the comparison group – 27.13±9.09% and 0.39±0.21 points, which also led to a delay in the start of the active period of orthodontic treatment in this group.

Table 1.

Values of the BOP, API, GI indices and the level of salivary lactate dehydrogenase in orthodontic patients with initial-I stage of severity of CGP before and during the active period of orthodontic treatment

Indicators	Before treatment of CGP		After treatment of CGP		3 months after braces are fitted		6 months after braces have been fitted	
	The main group	Comparison group	The main group	Comparison group	Main group	Comparison group	Main group	Comparison group
BOP (%)	79,03±7,67	75,24±18,97	1,83±0,71*** #	10,24±9,60***	7,85±3,18*** ###	43,48±23,12	0,28±0,2*** ##	17,45±9,94***
API (%)	78,4±22,14	76,22±22,74	3,02±2,3*** ##	27,13±9,09**	11,13±10,12*** ###	70,64±17,98	3,04±1,85*** ###	73,96±29,89
GI (points)	0,99± 0,32	1,18±0,28	0,05±0,04*** #	0,39±0,21**	0,07±0,05*** #	0,59±0,33	0,06±0,06***	0,34±0,31**
LDH (U/L)	1536,4±436,1	1446,1±441	353,1±94,7*** ###	1040±217,1	424,52±103,5*** ###	1687,6±240,8	375,8±102,4*** #	774,5±177,8*

Notes: 1. * – significance of differences between the groups «before treatment of CGP» and the groups at the stages of observation,

where * – $p<0.05$, ** – $p<0.01$, *** – $p<0.001$

2. # – significance of differences between the indicators of the main group and the comparison group at the stages of observation,

where # – $p<0.05$, ## – $p<0.01$, ### – $p<0.001$

After the beginning of the active period of orthodontic treatment and installation of braces, despite the high level of motivation, patients always show a tendency to deterioration of the level of individual hygiene due to painful reactions and difficult adaptation to new conditions. However, in the main group, 3 months after the start of the active period of orthodontic treatment, there was a minimal increase in the BOP (7.85±3.18%), ARI (11.13±10.12%) and GI (0.07±0.05 points) indices, which indicated a slight destabilisation of the situation, which required only minor correction. At the same time, patients in the comparison group showed an active increase in index indicators – BOP (43.48±23.12%), API (70.64±17.98%) and GI (0.59±0.33 points), which confirmed the loss of remission and required a repeated full course of treatment with a traditional regimen.

After 6 months of active period of orthodontic treatment, the repeated indices allowed to state in patients of the main group the practical absence of signs of inflammation in the form of gingival edema and bleeding, as evidenced by very low residual values of the BOP bleeding index – 0.28±0.2% in contrast to the comparison group – 17.45±9.94% ($p<0.001$). The absence of inflammation in the tissues of the periodontal complex of patients in the main group resulted in better API and GI indices – 3.04±1.85% and 0.06±0.06 points, respectively. While in patients of the comparison group, against the background of exacerbation of the pathological process in periodontal tissues, the API index was statistically significantly higher than the result obtained in patients of the main group – 73.96±29.89% and practically did not differ from the previous indicator «before treatment». GI scores also indicated the presence of a persistent inflammatory process in the gingival tissues – 0.34±0.31 points ($p<0.01$) (Table 1).

The analysis of the obtained indicators of the level of lactate dehydrogenase (LDH) in the oral fluid suggested that the presence of initial-I stage severity of CGP in patients and the installation of fixed orthodontic appliances caused a shift in the local energy metabolism (Table 1). Thus, before periodontal treatment, in both groups of patients with initial-I severity of CGP, an increase in the activity of LDH in the oral fluid was noted (1536.4±436.1 units/l in the main group and 1446.1±441 units/l in the comparison group against 135.0-214.0 units/l – the reference values of the norm of LDH in the oral fluid). At the same time, during the entire study period, in all patients of the main group and the comparison group, serum LDH levels did not exceed the reference norm, namely 248 units/l.

At the stage of periodontal treatment, the use of a treatment regimen with electrophoresis in combination with GCB in the main group helped to significantly reduce LDH levels and bring them as close as possible to normal values - 353.1±94.7 units/l ($p<0.001$) against 1040±217.1 units/l in the comparison group. In three months and 6 months after the installation of fixed orthodontic appliances in the main group, LDH values were statistically significantly different from those «before treatment» and were a convincing confirmation of a quantitative reduction in oxidative stress in the tissues of the periodontal complex (424.52±103.5 units/l ($p<0.001$) and 375.8±102.4 units/l ($p<0.001$)). Patients in this group were free of edema, bleeding, periodontal pockets and pain. While in the comparison group, the installation of braces led to a sharp increase in LDH levels – up to 1687.6±240.8 units/l, which to some extent exceeded this indicator of the same group before periodontal treatment (1446.1±441 units/l), indicating the presence of a significant local stress-modulating reaction and insufficient effectiveness of the traditional treatment regimen. Patients complained of severe discomfort in the oral cavity, symptomatic gingivitis was accompanied by a bulbous increase in interdental papillae and bleeding during probing. And only after 6 months, the level of oral fluid LDH slightly decreased (774.5±177.8 units/l), probably to a greater extent due to the inclusion of general adaptive mechanisms.

Discussion

Thus, the clinical efficacy of differential correction of local metabolic stress-modulated disorders in orthodontic patients with the initial-I degree of severity of CGP was studied by the developed treatment and prophylactic complex, which included a modified electrophoresis procedure in periodontal tissues using individually made mouthguards with the patented gel composition «Benzidaflaziverdine» based on a flavonoid complex and benzidamine hydrochloride. The essence of the technique of gingival electrophoresis with GCB before active orthodontic treatment was to remove all signs of chronic inflammation in periodontal tissues and to ensure an adaptive transitional preparatory

period before the installation of fixed orthodontic appliances. And after three months of active orthodontic treatment, the developed scheme was used for preventive maintenance of remission.

The inclusion of the electrophoresis procedure in combination with GCB in the complex of therapeutic and preventive measures during the active period of orthodontic treatment in patients with DA against the background of treated CGP led to a more intensive normalisation of BOP, API, GI and LDH levels. There was a faster improvement in the condition of periodontal tissues, which ensured a favourable course of the active period of orthodontic treatment in such patients.

In general, electrophoresis is recommended by researchers in the field of periodontics, because by irritating the abundant receptor field of the oral mucosa, it has a reflex effect, having a beneficial impact on the nervous system, its autonomic department and haemodynamics. As a result, blood and lymph circulation, trophism and metabolism in the periodontium improve, the growth of granulations in periodontal pockets is suppressed, inflammatory and congestive phenomena are reduced. There is an increase in the activity of connective tissue elements, phagocytic activity of leukocytes and elements of the reticuloendothelial system, accelerated regeneration, etc [19]. After all, physical procedures act on the body in a neuro-reflex and neuro-humoral way. As a result of the body's adaptation to the effect of a therapeutic stimulus, its defences increase. Therefore, based on the results obtained in the course of this study, it can be assumed that prior to the installation of fixed orthodontic appliances under the influence of electrophoresis, the necessary adaptation of periodontal tissues probably occurred. And the developed gel composition, thanks to two active components – the flavonoid complex contained in Proteflazid drops (Herba Deschampsia caespitosa L.) and ground cinquefoil herb (Herba Calamagrostis epigeiosL.) and benzidamine hydrochloride, which in addition to anti-inflammatory has a pronounced analgesic effect, contributed to the effective elimination of manifestations of the inflammatory process in periodontal tissues. This made it possible to obtain better results in the main group than in the comparison group. This is also important because today the main biological periodontal pathogens are rapidly developing resistant strains to classical antibiotics. Accordingly, such studies aim to formulate alternative options for combating pathogens by using herbal and non-steroidal anti-inflammatory drugs with anti-inflammatory, antibacterial, antioxidant and other properties [20].

According to some authors, the use of oral fluid enzyme indices in the diagnosis of various degrees of generalised periodontitis allows for a more accurate prediction of the development of the pathological process, timely initiation of treatment and monitoring of its effectiveness. Today, salivary biomarkers have become more popular than gingival (crevicular) fluid markers, in particular in assessing LDH activity during orthodontic movement of teeth using different values of continuous orthodontic forces. At the same time, LDH is also important in various physiological and pathological processes. Increased LDH activity is observed in conditions of hypoxia –insufficient oxygen supply to tissues, which largely accompanies CGD [21].

Conclusions

According to the results of changes in the periodontal status of orthodontic patients with initial-IV severity of CGP, it is possible to note the expediency of using the developed periodontal gel composition based on a flavonoid complex and a non-steroidal anti-inflammatory drug – benzidamine hydrochloride under the patented name «Benzidaflaziverdin» in combination with electrophoresis in the tissues of the periodontal complex before and during active orthodontic treatment. The clinical effectiveness of this treatment regimen was confirmed by the BOP API and GI indices. The studies also suggested that the level of LDH is a sensitive marker that reflects the biological activity that occurs in the periodontium in CGP before periodontal treatment and during the first three months of orthodontic movement of teeth. Therefore, the indicators of this enzyme can be used as a diagnostic tool for monitoring orthodontic treatment in patients with periodontal tissue pathology.

Thus, GCB can be recommended as a new dental product in clinical periodontics and orthodontics for periodontal patch applications and for «intensive» electrophoresis physiotherapy in the preparation of orthodontic patients for the active period of orthodontic treatment as a local therapy after SRP protocol or other surgical interventions and in the context of the use of fixed orthodontic appliances.

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Клінічна оцінка ефективності електрофорезу із пародонтальною гелевою композицією на основі флавоноїдного комплексу за умов стрес-модулюючого впливу незнімної ортодонтичної техніки на тканини пародонта

Годований О.В.

Вступ. Однією з важливих біологічних реакцій на ортодонтичне лікування брекет-системами є оксидативний стрес, який у пацієнтів із захворюваннями пародонта пов'язаний із низкою прозапальних факторів та явищами гіпоксії.Розпрацювання ефективних лікувальних схем з метою усунення наслідків оксидативного стресу місцевого характеру та використання адекватних прогностичних маркерів для його регуляції є важливим перспективним напрямком у лікуванні ортодонтичних пацієнтів із захворюваннями тканин пародонта.

Метою даного дослідження була оцінка клінічної ефективності розпрацьованого лікувально-профілактичного комплексу, що включав модифіковану процедуру наясенного електрофорезу в поєднанні з пародонтальною гелевою композицією «Бензидафлазівердин» (ГКБ), що складається з двох активних компонентів – флавоноїдного комплексу та бензидаміну гідрохлориду при лікуванні хронічного генералізованого пародонтиту (ХГП) початкового–I ступеня тяжкості в ортодонтичних пацієнтів до та у процесі активного періоду ортодонтичного лікування за умов місцевого оксидативного стресу.

Матеріали і методи. Об'єкт даного дослідження – 118 пацієнтів віком 20-35 років з діагностованими різними видами ЗЩА на тлі ХГП початкового-I ступеня, поділених на дві групи. У пацієнтів основної групи (60 осіб) застосовували розпрацьований лікувально-профілактичний комплекс з модифікованим наясенним електрофорезом та ГКБ до активного періоду ортодонтичного лікування та під час його перебігу (3 і 6 місяців). Пацієнти групи порівняння (58 осіб) у такі ж терміни отримували традиційну схему лікування, що включала аплікації з гелем «Холісал».Для оцінки ефективності проведеного лікування проводили розрахунок індексів BOP, API та GI.У якості прогностичного маркера місцевого оксидативного стресу у роботі використано значення рівня лактатдегідрогенази (ЛДГ) у ротовій рідині.

Результати. Включення процедури електрофорезу у поєднанні з ГКБ до комплексу лікувально-профілактичних заходів до та під час активного періоду ортодонтичного лікування у пацієнтів основної групи призводило до більш інтенсивної нормалізації показників індексів BOP, API, GI та рівня ЛДГ. Відбувалося більш швидке покращення стану тканин пародонта, що забезпечувало сприятливий перебіг активного періоду ортодонтичного лікування. В основній групі через 3 місяці після початку ортодонтичного лікування відбувалося мінімальне підвищення показників індексів BOP (7,85±3,18%), API (11,13±10,12%) та GI (0,07±0,05 балів), що свідчило про легку дестабілізацію ситуації, яка потребувала лише незначної корекції. У той час як у пацієнтів групи порівняння простежували активний ріст індексних показників – BOP (43,48±23,12%), API (70,64±17,98%) та GI (0,59±0,33 балів), що підтверджувало втрату ремісії та вимагало застосування повторного курсу лікування традиційною схемою.Якщо після встановлення брекет-систем в основній групі показник ЛДГ перебував у межах 424,52±103,5 од/л ($p<0,001$), то у групі порівняння це зумовило різке підвищення показника до 1687,6±240,8 од/л, що певною мірою перевищило показник тої ж групи порівняння до пародонтологічного лікування (1446,1±441 од/л) та свідчило про наявність значної місцевої стрес-модулюючої реакції і недостатню ефективність традиційної схеми лікування.

Висновки. За результатами змін пародонтального статусу та показників ЛДГ в ортодонтичних пацієнтів з ХГП можна зазначити доцільність застосування розпрацьованої ГКБ у поєднанні електрофорезом в тканини пародонтального комплексу до та впродовж активного ортодонтичного лікування. Клінічна ефективність запропонованого лікувально-профілактичноо комплексу була підтверджена показниками індексів BOP, API та GI. Проведені дослідження також дозволили припустити, що рівень ЛДГ є чутливим маркером, що відображає біологічну активність, яка відбувається в пародонті при ХГП до пародонтологічного лікування та впродовж перших трьох місяців ортодонтичного руху зубів. Тому показники цього ферменту можна використовувати як діагностичний інструмент для моніторингу ортодонтичного лікування в пацієнтів з патологією тканин пародонта.

Ключові слова: ортодонтичні пацієнти, пародонтит, оксидативний стрес, лікування, гелева композиція, флавоноїди, електрофорез, ротова рідина, лактатдегідрогеназа.

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