Peculiarities of Carbohydrate Exchange in Patients with Generalized Periodontitis of Young Age Persons

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Abstract
There were studied 92 somatically healthy persons of young age (18-25 years old), with generalized periodontitis (GP) of initial-I degree of development, among them: 30 patients with chronic generalized periodontitis (CGP), who were included into group I; and 32 patients with exacerbation of the chronic generalized periodontitis (ECGP) - into group II; and 30 healthy patients. The carbohydrate metabolism indexes were studied, namely: the content of glucose, pyruvate (pyruvic acid) and lactate (lactic acid) and lactate dehydrogenase activity (LDG) in the oral liquid.

We have determined that in the presence of CGP of the initial-I degree of development, and especially in its exacerbation, there is a significant increase of indicators of carbohydrate metabolism. In young patients with CGP indicators of glucose, pyruvate, lactate and LDG activity in the oral liquid increased by 2.0, 1.34, 1.58 and 1.37 (p<0.001, p<0.01) times respectively, and in case of ECGP they grew even more: by 2.71, 1.98, 1.76 and 2.07 (p<0.001) times, respectively.

Among all the indicators, that characterize the carbohydrate metabolism, in addition to the level of pyruvate, in case of different course of GP a significant difference was revealed: in patients with ECGP compared with the data in CGP, glucose and lactate levels and LDG activity in the oral liquid were significantly higher - at 35.75% (p<0.05), 34.29% (p<0.01) and 36.59% (p<0.001) respectively.

Detected violations of carbohydrate metabolism indeces in the oral liquid indicate the involvement of these processes in the pathogenesis of GP and the necessity of their correction.

Keywords
generalized periodontitis; oral fluid; carbohydrate metabolism

Problem statement and analysis of the recent research
Diseases of periodontal tissues, especially GP is one of the most topical problems of dentistry, which acquires a high social significance, caused by a considerable prevalence of the disease in young people and the possibility of development of severe changes in periodontal tissues and the body of the patient as a whole [1, 7, 13]. Having remission periods and exacerbation, the GP often significantly impairs the functions of the dentofacial system because of the bony tissue resorption and damage of the retaining apparatus of the teeth [3].

The most recent data on the problems of etiopathogenesis of GP suggest that besides morpho-functional disorders of the tooth-jaw system, there is a number of violations in the metabolic status of the patient’s body, in particular, protein and carbohydrate metabolism [8, 11]. In this case, the metabolism of carbohydrates in patients with GP, especially in young people, was barely studied. In this regard, the study of the state of carbohydrate metabolism in patients with GP is relevant.

The objective of the research is to study the parameters of carbohydrate metabolism in the mouth fluid of young people with GP of initial-I degree of development of the chronic and severe course.

1. Material and methods of the research
There were examined 92 somatically healthy persons aged 18-25 years. They were divided into groups as follows: group I - patients with chronic generalized periodontitis (CGP) of initial-I degree of development, which included 30 people; group II - patients with exacerbation of chronic generalized periodontitis (ECGP) of initial-I degree of development, which included 32 persons; 30 people were a group of healthy ones.

To reveal the biochemical components of the development of the GP (in particular, the role of carbohydrate metabolism) oral liquid as the optimal and non-invasive biomaterial was taken, which is a rather informative source of the research. In addition, this method of study attracts attention with the ease of taking the material and the possibility of multiple sampling [4].

The collection of unstimulated oral fluid was performed in centrifuge tubes for 5 minutes in the morning, in the fasting state, without early hygiene, in 3 minutes after rinsing the mouth with water. After centrifugation (2500 q, 5 min, at 0... + 5°C), the volume of oral fluid was measured and the supernatant fluid was taken into the clean test tubes.
The content of glucose in the oral liquid was determined using the glucose oxidase method [6]. Determination of the amount of pyruvate was performed colorimetrically [10]. The level of lactate was determined by the enzymatic method of Buchner [2]. The activity of LDG was determined by the kinetic UV method using reagents of the LLC Scientific-Research Enterprise “Filisit-Diahnostyka” (Dnipropetrovsk, Ukraine) [10].

2. Results of the research and their discussion

We have determined that in the oral liquid of young people with GP of the initial-I degree of development, the parameters of carbohydrate metabolism were statistically significantly changed (Table 1).

In particular, the glucose level in patients with CGP (group I) increased by 2.00 (p<0.001) times in healthy patients and by 2.71 (p<0.001) times in patients with ECGP (group II).

Study of metabolites of carbohydrate metabolism indicates a significant increase in the level of pyruvate, in particular, in CGP - in 1.34 (p<0.001) times, and in ECGP - in 1.98 (p<0.001) times.

One should note the accumulation of the product of anaerobic oxidation of glucose - lactate, whose concentration in patients of group I increased in 1.58 (p<0.001) times, and in group II - in 1.76 (p<0.001) times.

The high content of pyruvate and lactate in the oral liquid of both experimental groups of patients indicates the high intensity of carbohydrate metabolism in the organs and tissues of the oral cavity. On the other hand, this leads to a violation of the oral liquid pH due to the accumulation of acidic products, which in turn creates a favourable environment for the vegetation of pathogenic microflora [12].

Regarding the LDG activity in the oral liquid of patients in group I, it increased in 1.37 (p<0.01) times, and in patients of group II - in 2.07 (p<0.001) times compared with healthy ones.

To find out the depth of metabolic disorders in the oral cavity of young patients with GP in case of different course of the disease, we have performed a comparative analysis of the studied parameters.

In particular, the level of glucose in GP has significantly increased in both variants of the disease course (Fig. 1). However, in case of exacerbation, markedly higher rates were noted - at 35.71% (p<0.05).

Regarding the content of pyruvate, it should be noted that this index in patients with ECGP of initial-I degree of development (Fig. 2) was significantly higher compared with the indicator found in group I - at 34.29% (p<0.001).

When comparing lactate levels in patients with GP (Fig. 3), no significant differences were observed in case of a different course of the disease.

The LDG activity was also significantly higher in the oral fluid of young people with ECGP of the initial-I degree (Fig. 4), and the difference with the data in patients with CGP according to this indicator was significant and amounted 36.59% (p<0.001).

So, assessing the state of carbohydrate metabolism in the oral fluid in patients with CGP and ECGP of the initial-I degree of development, we determined the significant changes in all studied parameters compared with the data in healthy persons. In addition, a comparative analysis between groups I and II of patients indicates a significant difference between the parameters of carbohydrate metabolism, depending on the course of GP: more profound changes were observed in the oral liquid of patients in ECGP of the initial-I degree of development.

Obtained data suggest that GP is accompanied by the intense breakdown of disaccharides in the oral cavity with the release of glucose, both with the participation of the enzymes of saliva and microorganisms’ enzymes. On the background of glucose increase, an intensification of glucose utilization processes is observed, which is confirmed by an increase of the level of such metabolites as pyruvate lactate [12, 14]. Accumulation of these acids causes violation of the pH of the oral liquid, which is important for the functioning of the pathogenic microflora in the oral cavity and can be considered as an important factor in breaking of the barrier function of the epithelial cells of the gums; that, in turn, leads to an increase of inflammation in the gums, which occurs in exacerbation of the pathology of periodontal disease [5].

The prospect of further research is the development of a method for complex treatment of patients with GP in young people, which would include the regulation of the determined metabolic disorders.

3. Conclusions

1. Under the conditions of GP in young people, there are reliable changes in the carbohydrate metabolism in the oral liquid: level of glucose, pyruvate, lactate and LDG activity in comparison with healthy ones, increase in chronic disease in 1.3-2.0 times, and in acute one - in 1.76-2.71 (p<0.01-0.001) times.

2. Among the indicators of glucose and lactate levels and LDG activity in the oral liquid of patients with GP of chronic and acute course, the probable differences were established: in ECGP they were 34.29-36.59% (p<0.001) higher than those in CGP.

3. Our findings of carbohydrate metabolism violations in the oral fluid indicate the involvement of these processes in the pathogenesis of GP and the necessity of their correction.

References

Figure 1. Graphical representation of the comparison of the glucose amount in the oral fluid of young patients with chronic generalized periodontitis of the initial-I degree of development, in different course of pathology.

Figure 2. Graphical representation of the comparison of the pyruvate amount in the oral fluid of young patients with chronic generalized periodontitis of the initial-I degree of development, in different course of pathology.
Figure 3. Graphical representation of the comparison of the lactate amount in the oral fluid of young patients with chronic generalized periodontitis of the initial-I degree of development, in different course of pathology.

Figure 4. Graphical representation of the comparison of the lactate dehydrogenase amount in the oral fluid of young patients with chronic generalized periodontitis of the initial-I degree of development, in different course of pathology.
Table 1. Indicators of carbohydrate metabolism in the oral fluid of young persons, patients with generalized periodontitis of the initial-I degree of development, in a different variant of the course (M±m)

<table>
<thead>
<tr>
<th>Indexes</th>
<th>Healthy, n=30</th>
<th>Patients with GP of the initial-I degree of development</th>
<th>Patients with CGP, I group, n=30</th>
<th>Patients with ECGP, II group, n=18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose, mmol/l</td>
<td>0.07±0.01</td>
<td>0.14±0.01***</td>
<td>0.19±0.02***</td>
<td></td>
</tr>
<tr>
<td>Pyruvate, µmol/l</td>
<td>28.17±0.68</td>
<td>41.47±1.31***</td>
<td>55.69±1.84***</td>
<td></td>
</tr>
<tr>
<td>Lactate, mmol/l</td>
<td>0.29±0.02</td>
<td>0.46±0.04***</td>
<td>0.51±0.02***</td>
<td></td>
</tr>
<tr>
<td>LDG, µmol/min/l</td>
<td>0.27±0.02</td>
<td>0.41±0.02 ***</td>
<td>0.56±0.03 ***</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The probability of difference is indicated: p<0.01 – ***, p<0.001 – *** – up to the value in healthy ones.


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