COMPARATIVE ANALYSIS OF CELLULAR COMPONENTS IN CHRONIC CATARRHAL GINGIVITIS IN CHILDREN

Resume: This research revealed the structure of periodontal diseases in children in Kyzylorda and Talgar regions. A cytological analysis of gingival fluid in chronic catarrhal gingivitis was performed. It was found that periodontal diseases were a fairly common pathology in 66.5% of children in the main group (21.4% in the control group). The cytological analysis of gingival fluid showed the presence of dystrophically altered epithelial cells, an increase in the number of epithelial cells contaminated with microorganisms, the percentage of which was significantly higher in children of the main group than in children of the comparison group (P<0.05). Loosening of the epithelial layer was noted, as evidenced by increased indices of the IMEC index (index of multicellular epithelial complexes) (P<0.05). The large number of erythrocytes detected in gingival fluid smears in children of the main group compared with the comparison group indicates a violation of the permeability of the gum vascular walls.

Keywords: parodontium, epitheliocytes, destruction, cytology, catarrhal gingivitis

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(P<0,05). Выявленное в мазках десевой жидкости большого количества эритроцитов у детей основной группы по сравнению с группой сравнения свидетельствует о нарушении проницаемости стенки сосудов десны.

Ключевые слова: пародонт, эпителиоцит, деструкция, цитология, катаральный гингивит

Introduction: Due to the high prevalence of parodontal diseases, parodontology is becoming one of the most sought-after sections of dentistry. Thus, the prevalence of parodontal diseases in children increases, if, according to some researchers, the prevalence of parodontal diseases in schoolchildren was 39%, periodontitis was more common at puberty (13-15 years) and amounted to 7.7% and 11.3% at 16-18 years. At the same time, in children with general pathology, the prevalence of parodontal diseases is significantly higher — 35-40%[1,3]. At the same time, some authors note that parodontal diseases occur in 92-100% of 12- and 15-year-olds. Bleeding gums is observed in 39%, tartar – up to 82% pathological pocket – in 4% of schoolchildren of this age. Signs of parodontal tissue damage occur, according to the authors, as early as the age of 7. A significant increase in parodontal disease is detected in children aged 13-15 years during puberty. Hormonal dysfunctions during this period (violation of the ovarian-menstrual cycle and others) they contribute to the development of catarrhal and hypertrophic gingivitis. Functional insufficiency of the gonads causes the development of inflammatory and dystrophic changes in parodontal tissues[2,3,4].

According to the literature, the peculiarities of the development of parodontal diseases in children is associated with the fact that the pathological process develops in growing, constantly rebuilding tissues that make up the parodontium, in tissues morphologically and functionally immature, capable of inadequately responding even to minor damaging factors[5,7,3]. On the other hand, parodontal pathology can develop against the background of disproportion of growth and maturation of tissue structures both within a system with uniform functions (tooth, periodontium, alveolar bone) and in structures and systems that provide the entire body and adapt it to changes in the external environment (nervous, humoral, endocrine, etc.), which causes the occurrence of parodontal diseases in the juvenile period [5,7,10,11,12]. Parodontal diseases are accompanied by complex morphofunctional changes in tissues, the severity of which depends on both the general condition of the body and the age-related features of the structure of parodontal tissues.

It is also well known that with a long-term pathological process during the growth and development of a child, there is a violation of tissue formation, which leads to the destruction of the entire periodontal complex[2,9,13]. It should be noted that the permeability of histohematic barriers is also reduced due to the appearance of perivascular accumulations of round-cell elements (lymphocytes, histiocytes). This creates prerequisites for a prolonged, chronic course of pathological processes in the gum[6,7,14]. Longer-term pathological processes lead to impaired tissue formation and early destruction of the parodontal complex, the development of mobility and tooth loss.

At the same time, sufficiently reliable and simple laboratory methods for the diagnosis and monitoring of parodontal diseases among children in the early stages of the disease have not yet been developed, despite the wide variety of available methods and tools. In this regard, according to the data, new and already known methods of their diagnosis and treatment are being actively sought and modified.

The aim of the work was to examine the clinical picture of periodontal diseases and a comparative analysis of cellular changes in chronic catarrhal gingivitis in children.

Materials. This work was carried out within the frames of Grant financing of the Ministry of Education and Science of the Republic of Kazakhstan. During the research, we determined the dental status with parodontal tissue diseases in children from 7 years old to 16 years old, which includes the identification of the prevalence, structure and clinical forms of parodontal diseases in the Kyzylorda region. To this purpose, we examined 500 children in Arazk, Kyzylorda and the village Sheli. Of these, 256 are boys, 242 are girls. For a comparative assessment of dental and parodontal statuses, 428 children of Almaty and Almaty region were examined, 204 of them boys and 224 girls. Dental status was determined by generally accepted methods in compliance with ethical standards, i.e. parents signed informed consents. For the diagnosis of parodontal diseases, Green-Vermillion indexes, PMA, and the Schiller-Pisarev test were used.

The object of cytological examination were smears-prints of gingival fluid taken from 45 children in the comparison group (Talgar) and 60 children of the Kyzylorda region (the main group). Gingival fluid was obtained using sterile filaments of a bandage from the gingival furrow, while cotton tampons isolated the gingival groove from saliva and placed the threads in them for 2-3 minutes. After that, the cheesecloth filaments were removed and smears were prepared on cytological glasses. They were dried, fixed in alcohol-acetone (1:1) and stained according to May-Grunwald and Romanovsky-Giemse. Based on the results of the cytogram, a number of indices were calculated: cell differentiation (DI), left shift (IL), multicellular epithelial complexes (IMEC), destruction of epithelial cells (ID), inflammatory destructive (IDI). The reliability of differences in averages was assessed using the Student’s criterion, in which changes in indicators were considered reliable at P< 0.05.

The results of the research showed that parodontal diseases were a fairly common pathology in 66.5% of children in the main group (21.4% in the control group). Of these: chronic catarrhal gingivitis in 76.2% of cases, chronic localized parodontitis – in 13.6% of cases, chronic generalized parodontitis – in 9.2% of cases, chronic hypertrophic parodontitis - in 1.1% of cases. It follows from the above that the prevailing parodontal disease was chronic catarrhal gingivitis (76.2%), and in 80.1% of cases due to the unhealthy content of the oral cavity. In all cases, there was an unsatisfactory oral hygiene index (2.1+ 0.11), a high attachment of the frenulum of the upper lip, shallow vestibule - in 91% of cases, caries and its complications - in 90.3%
violation functions of swallowing, breathing (oral), violation of occlusion with an improperly applied seal - in 3.8%, bad habits - in 16.0%, the presence of dental anomalies - in 60.9% of cases and there were orthodontic constructions – 13.1%, which were also a factor of poor hygiene. At the same time, all children had insufficient load on the chewing muscles, i.e., too frequent consumption of soft foods. All of the above together contributes to the development of an imbalance of microorganisms in favor of pathogenic microflora, which causes parodontal diseases. The clinical picture of parodontal inflammation depends on the damaging factor, the intensity and duration of its effects, which contributes to the development of various forms of parodontal diseases.

The results of cytological analysis of gingival fluid in both groups indicate the content of smears of segmented neutrophils in the cytogram, which are partially destroyed and the presence of active vacuolated neutrophils. The percentage of neutrophils in the cytogram of gingival fluid in patients of the main group was significantly higher than in patients of the comparison group (P< 0.05) (Table 1). Cytogram analysis showed that a significant number of intact monocytes were present in the comparison group. Holonuclear monocytes were found in the main group (Table 1). In the cytogram of gingival fluid, erythrocytes were detected in most patients of the main group, whereas in patients of the comparison group they were isolated.

**Table 1 - Cytogram of gingival fluid in children with chronic catarrhal gingivitis**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Chronic catarrhal gingivitis, %</th>
<th>P</th>
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<tbody>
<tr>
<td></td>
<td>Comparison group (Talgar)</td>
<td>The main group (The Aral Sea region)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>Basal epithelial cells, %</td>
<td>1,4±0,11</td>
<td>2,9±0,2</td>
</tr>
<tr>
<td>Parabasal epithelial cells, %</td>
<td>1,5±0,1</td>
<td>3,3±0,15</td>
</tr>
<tr>
<td>Intermediate epithelial cells Type I, %</td>
<td>6,3±0,25</td>
<td>7,8±0,4</td>
</tr>
<tr>
<td>Intermediate epithelial cells Type II, %</td>
<td>17,0±0,6</td>
<td>9,6±0,96</td>
</tr>
<tr>
<td>Surface epithelial cells with a pyknotic nucleus, %</td>
<td>36,9±2,3</td>
<td>23,4±1,9</td>
</tr>
<tr>
<td>Nuclear-free epithelial cells, %</td>
<td>1,31±0,3</td>
<td>1,22±0,23</td>
</tr>
<tr>
<td>Segmented neutrophils, %</td>
<td>32,1±2,4</td>
<td>46,2±3,0</td>
</tr>
<tr>
<td>Intact mononuclears, %</td>
<td>3,5±0,13</td>
<td>3,3±0,14</td>
</tr>
<tr>
<td>Holonuclear mononuclears, %</td>
<td>0</td>
<td>2,2±0,13</td>
</tr>
<tr>
<td>Dystrophically altered epithelial cells, %</td>
<td>2,0±0,08</td>
<td>4,0±0,22</td>
</tr>
<tr>
<td>Epithelial cells with invasion of neutrophils and monocytes, %</td>
<td>5,6±0,13</td>
<td>10,1±1,1</td>
</tr>
<tr>
<td>Dif(differentiation index)</td>
<td>440,36±8,0</td>
<td>405,79±8,3</td>
</tr>
</tbody>
</table>
Epithelial cells of all stages of differentiation were detected in gingival fluid smears in both groups. But in chronic catarrhal gingivitis in children of the main group, the percentage of basal, parabasal and intermediate type 1 cells was increased, due to a decrease in the number of intermediate type 1 epithelial cells, surface epithelial cells with a pylomatic nucleus and non-nuclear epithelial cells. Cytogram analysis indicates that the content of basal, parabasal and intermediate type 1 epithelial cells was significantly higher in children of the main group than in patients of the comparison groups (P<0.05) (Table 1). Fibroblast-like cells were found in smears in patients of the main group and the comparison group.

It should be noted that dystrophically altered epithelial cells with signs of hydropic dystrophy and invasion of neutrophils and monocytes into epithelial cells were present. The percentage of dystrophically altered epithelial cells and epithelial cells with invasion of neutrophils and monocytes was significantly higher in children of the main group than in patients of the comparison groups (P<0.05) (Table 1). Mucin filaments and contamination of coccal microflora and rod-shaped bacteria were found in places.

Discussion. The large number of erythrocytes detected in gingival fluid smears in children of the main group compared with the comparison group indicates a violation of the permeability of the gingival vascular wall and may be a characteristic cytological marker of the action of damaging factors. The development of inflammatory and destructive reactions in the periodontium is indicated by an increase in the cytomgram of a large number of segmented neutrophils and active vacuolated, mostly destroyed cells. The inflammatory and destructive processes in periodontitis are also indicated by high rates of IDI, both in the main group and in the comparison group (P<0.01) (Table 1). A high degree of alteration in the lesion is indicated by the appearance in the cytomgram of the main group and the comparison group of holonuclear cells – mononuclear cells devoid of cytoplasm, and fibroblast-like cells.

A significant increase in IL and decrease in IDIF in the balance of epithelial cells (P<0.05) (Table 1) of cells is characteristic of inflammation and reflects the overall rejuvenation of epithelial cells associated with their increased proliferation. The mitotic index of the epithelium of the oral mucosa increased depending on the degree of inflammation and age.

The result of loosening of the epithelial layer is indicated by increased indices of the IMEC index (P<0.05) (Table 1), which occurred as a result of pronounced destructive changes in epithelial cells and rupture of intercellular contacts, an increase in desquamation processes. The presence of small and large droplet vacuolation of cytoplasm and basophilic inclusions led to dystrophically altered epithelial cells. These changes are evidenced by a significant increase in ID (P<0.05), characteristic of the damaging effect of the pathological process in the oral mucosa, accompanied by pronounced structural changes in its tissue components and epithelial cells Table 1.

Both in the comparison group and the main group, the number of epithelial cells with invasion of neutrophils or mononucleares of the 6th, 5th, 4th, 3rd and even 2nd stages of differentiation in the gingival fluid significantly increased, the cytoplasm of which included one or more nuclei of segmented neutrophils or mononucleares. The appearance of epithelial cells with invasion of neutrophils and mononucleares indicates a high activity of the inflammatory process and aggressiveness of infiltrate cells.

There is an increase in the number of epithelial cells contaminated with microorganisms at various stages of differentiation, including young parabasal cells. In the cytoplasms of epithelial cells and on their surface, various bacteria are detected in the form of cocci and rod-shaped bacteria that form filamentous structures. This indicates loosening of the epithelial layer cells due to weakening of intercellular contacts and associated with destructive changes in the epithelium of the gingival mucosa, which indicates a decrease in its barrier functions.

Thus, despite the uniformity of clinical observations, the detected cytological changes were more pronounced in children of the main group compared with patients of the comparison group. This is due to the high sensitivity of parodontal structures in childhood to the effects of harmful environmental factors.

Conclusions: the cytological analysis of gingival fluid showed

- the presence of dystrophically altered epithelial cells with signs of hydropic dystrophy,
- an increase in the number of epithelial cells contaminated with microorganisms, the percentage of which was significantly higher in children of the main group than in patients of the comparison groups (P<0.05).
- increased indices of the IMEC index (P<0.05), which occurred as a result of pronounced destructive changes in epithelial cells and rupture of intercellular contacts, indicate an increase in desquamation processes.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>IL (index of the left shift)</th>
<th>ID (index of epithelial destruction cells)</th>
<th>IDIF (inflammatory and destructive index)</th>
<th>IMEC (index of multicellular epithelial complexes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,5±0,12</td>
<td>12,8±1,4</td>
<td>9,17±0,4</td>
<td>3,4±0,1</td>
</tr>
<tr>
<td></td>
<td>12,9±1,4</td>
<td>79,2±4,6</td>
<td>14,9±0,6</td>
<td>12,9±0,11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P&lt;0.01</td>
</tr>
</tbody>
</table>

Note: P<0.01 – the reliability of differences in the indicators of patients with chronic localized parodontitis in the comparison group and the main group.
the large number of erythrocytes detected in gingival fluid smears in children of the main group compared with the comparison group indicates a violation of the permeability of the gingival vascular wall and may be a characteristic cytological marker of the action of damaging factors.

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