ASSESSMENT OF REGULATORY AND REPARATIVE OSTEONEogenesis IN AUGMENTATION AREA BASED ON ORAL FLUID METABOLIC PARAMETERS

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ABSTRACT — Cases of serious atrophy of the alveolar processes occurring during dental implantation could be restored saving the respective bone volume. There is also a need for postoperative monitoring of the physiological osteogenesis effectiveness in the peri-implant zone. Our paper offers an assessment of regulatory and reparative osteogenesis in the augmentation zone subject to the oral fluid (OF) metabolic parameters obtained from 59 patients. Biochemical methods for oral fluid examination are non-invasive approaches that allow identifying pathologies at the tissue and cellular level. The proposed metabolic indices of collagen C-telopeptide, osteocalcin, alkaline phosphatase (AP) and parathyroid hormone helped identify augmentation zone of disturbed reparation in 6.8% of patients, whereas the worst complications were to be observed one month after the implantation. Through this period, however, orthopantogram featured no pathological change. Given that, the biochemical markers of bone tissue remodeling are employed for early identification and developing a forecast regarding treatment effectiveness.

Aim of study:

to assess regulatory & reparative osteogenesis in the augmentation zone based on oral fluid metabolic indicators.

MATERIALS AND METHODS

The clinical study involved 59 people — 21 males (35.6%) and 38 females (64.4%) aged 35–60. The patients were divided into two groups. Group 1 (main group) included 42 persons (71.2%), who were at the stage of osseointegration in the augmentation zone of allogeneic demineralized lyophilized spongy bone tissue at the maxillary sinus. Group 2 (control group) included 17 (28.8%) clinically and somatically healthy individuals. The groups were comparable in terms of age, gender, and initial periodontal status. The object of the study was the oral fluid.

The study itself focused on biochemical markers of bone modeling (osteocalcin, alkaline phosphatase, parathyroid hormone) and collagen C-telopeptide — a marker of bone resorption (β-Gross Laps), while the obtained data were analyzed and underwent statistical processing.

RESULTS AND DISCUSSION

For the purpose of matching the metabolism of physiological osteogenesis vs the inflammation & destruction process, we set the metabolism biochemical markers indices in the control group aiming thus to identify the values of the norm criterion.
In the control group, the osteocalcin content was found to be 0.55±0.006 ng/ml; alkaline phosphatase — 26.9±2.68 U/l; parathyroid hormone — 1.89±0.13 ng/ml; collagen C-telopeptide — 0.01±0.02 ng/ml. Similar indicators were examined in the main group. The analysis showed that during Week 1, metabolic parameters remained within norm in all the patients of the main group. The subsequent analysis, though, revealed that the dynamics changed within one month (Table 1).

### Table 1. Oral fluid metabolic parameters dynamics in patients of the main group (n=42) depending on the follow-up period (M±m)

<table>
<thead>
<tr>
<th>Time</th>
<th>Number of observations</th>
<th>Indicator</th>
<th>Osteocalcin, ng/ml</th>
<th>Alkaline phosphatase, U/l</th>
<th>Parathyroid hormone, ng/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>n=42</td>
<td>Collagen C-telopeptide, ng/mg</td>
<td>0.01±0.003</td>
<td>0.56±0.006</td>
<td>27.0±2.45</td>
</tr>
<tr>
<td></td>
<td>n=0</td>
<td></td>
<td>0.01±0.002</td>
<td>0.57±0.005</td>
<td>26.3±1.8*</td>
</tr>
<tr>
<td>Week 2</td>
<td>n=40</td>
<td></td>
<td>0.01±0.05</td>
<td>0.55±0.06</td>
<td>27.02±2.36</td>
</tr>
<tr>
<td></td>
<td>n=2</td>
<td></td>
<td>0.015±0.003</td>
<td>0.75±0.04**</td>
<td>19.0±3.1**</td>
</tr>
<tr>
<td>Week 3</td>
<td>n=39</td>
<td></td>
<td>0.01±0.04</td>
<td>0.57±0.08</td>
<td>28.3±1.64</td>
</tr>
<tr>
<td></td>
<td>n=3</td>
<td></td>
<td>0.02±0.005**</td>
<td>0.82±0.04*</td>
<td>10.9±1.7*</td>
</tr>
<tr>
<td>1 month</td>
<td>n=38</td>
<td></td>
<td>0.009±0.09*</td>
<td>0.56±0.09</td>
<td>27.3±1.73</td>
</tr>
<tr>
<td></td>
<td>n=4</td>
<td></td>
<td>0.023±0.0009*</td>
<td>0.93±0.07*</td>
<td>5.7±0.4*</td>
</tr>
</tbody>
</table>

Note. Reliability of deviation from control: * – at p<0.05; ** – p=0.01

2 weeks following augmentation, for instance, there was a tendency observed, which featured a certain increase in collagen C-telopeptide in 2 patients; after 3 weeks, it doubled sharply in 3 patients, whereas a month later — in 4 patients. An increase in this criterion points at a destructive process in the augmentation zone, since during the resorption process, the telopeptide with the remnants of collagen molecules penetrates the oral fluid. However, the destruction cannot be judged based on one indicator only, therefore, other criteria were additionally employed to assess the osteogenesis status. The osteocalcin content was studied, and its increase in the OF, which was observed in 4 patients after 1 month, indicated a decrease in the mineralization at the area of augmentation, contributing to relative depletion of plastic resources.

The alkaline phosphatase levels in Week 1 went down slightly in one patient (0.97%), yet, 4 patients had the maximum decrease — more than 4 times down — in a month’s time. The decrease in the alkaline phosphatase activity serves proof to improper conditions for osteogenesis, namely, reduced inorganic phosphate supply at the stage of bone tissue mineralization.

The parathyroid hormone dynamics from Week 1 until 1 month of observation shows it doubling — if in C-telopeptide, parathyroid hormone and osteocalcin are indicative of destructive processes in the augmentation zone, whereas on the other, a decreasing activity of the alkaline phosphatase also indicates a slower bone formation. However, against the deep metabolic disorders, there was no change detected in these patients’ orthopantomograms, which indicates early signs of structural and regulatory insufficiency. In this regard, given the fact that that 4 out of 59 patients (6.8%) had a disturbed physiological osteogenesis, which reached its maximum after 1 month, it appears reasonable to assess the above-described oral fluid metabolic parameters during the said period, thus preparing to take appropriate measures.

### REFERENCES


