Salivary Alkaline Phosphatase Level Changes in Patients with Multiple Implants Surgery (Comparative Study)

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Abstract

**Background:** Alkaline Phosphatase includes a group of enzymes catalyzing the hydrolysis of phosphate esters in an alkaline medium. This enzyme plays important role in the bone metabolism.

**Objectives:** This study is purposed to determine the correlation between the level changes of alkaline phosphatase for patients in need multiple dental implants surgery.

**Materials and methods:** A random comparative cross sectional study were applied on patients requiring dental implants surgery. Forty patients included in this study who are aged from 30 to 40 years old, free of systemic diseases, not subjected to any surgical treatment for at least three months before his/here dental implant surgery, their dental implant number was 2-4 dental implant per whole mouth, not smokers, and regarding females; they were not pregnant or nursing. The patients attended the Oral & Maxillofacial Surgery Department in Al-ESraa University College Teaching Hospital/Baghdad. Two non-stimulated salivary samples accumulated from each patient, both of them was 5 ml, one at the day of the surgical procedure just 10 minutes prior the beginning of the dental implant surgical step (group A) and the other 10 days after the surgical procedure at the time of suture removal (group B), so the total samples was 80. The number of dental implants was 2-4 for each patient.

OT medical implant system / Germany and BIOMEREJUX/ France salivary alkaline phosphatase kit was utilized. SPSS version 24 was used for statistical analysis.

**Results:** There was significant difference between group A and group B (P=0.0005) with normal level of salivary ALP for group A with marked increase for group B. The level increase of salivary ALP is directly related to number of dental implants surgery.
Discussion: This is the first study in the literature that evaluated the salivary ALP test in relation to dental implant surgery as well as the number of dental implants. The resorption and reformation of bone is significant for micro fractures repair of the bone in dental implants surgery.

Conclusion: The salivary ALP is a reliable and less invasive biomarker for bone turnover. In dental implant surgery; the increased number of dental implants will increase salivary ALP level as there will be a higher bone remodeling.

Key words: salivary alkaline phosphatase; dental implants, bone remodeling.

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Introduction

Dental implants utilizing to replace missing teeth for most half a century, They are considered to be an significant involvement to dentistry world as they have transfigured the method via it the missing teeth are replaced with a great rate success.\textsuperscript{1,2} In spite of being mineralized, the bone is constantly renewed through means of the bone remodeling procedure. This procedure is characterized by bone resorption via osteoclasts, followed by bone formation via osteoblasts.\textsuperscript{3} Osseo integration, is a direct connection (structural and functional) between living bone and load-carrying implants surface.\textsuperscript{4} Biomarker is a biologic substance that could be evaluated and measured to serve as indicators of biologic health, ecological exposure, pathologic processes, and pharmacologic replies to a therapeutic involvement.\textsuperscript{5} Biochemical bone metabolism markers are classified into two types: enzymes reflecting the osteoblastic activity of (e.g., bone alkaline phosphatase), and osteoclasts (e.g., tartrate-resistant acid phosphatase), and markers of the organic bone matrix.\textsuperscript{6} Human saliva is a body fluid secreted via minor and major salivary glands that contain locally and systemically derived biomarkers.\textsuperscript{7} Saliva is a mirror of the body that can reflect normal and disease state and its use as a diagnostic fluid has many merits over serum. Whole salivary can be collected non-invasively, and by individuals with finite training, no special equipment is wanted for gathering the fluid, compliance problems is less and further, analysis of saliva can supply a cost-effective method for the screening of large number of populations.\textsuperscript{8,9} Interest of using saliva as a diagnostic medium has been increased in the last 10 years.\textsuperscript{10} ALP is a hydrolase enzyme accountable for removing the groups of phosphate from many types of molecules and is a marker of the metabolism of the bone.\textsuperscript{11} Liver, kidney, bone, intestine and placenta are the main source of alkaline phosphatase, it is also found in many cells of the periodontium including osteoblasts, neutrophils, fibroblasts.\textsuperscript{12} It is mainly released from polymorphonuclear neutrophils through their migration to the infection site, from osteoblast through the formation of the bone and from fibroblast in periodontal ligaments during regeneration of periodontium.\textsuperscript{13}
Alkaline phosphatase appears to be included in the mineralization operations.\textsuperscript{14, 15} It is enriched invesicles of matrix, which possibly show a role in the processing of extracellular matrix and calcification of the bone.\textsuperscript{16} Alkaline phosphatase (ALP) was the earliest bone remodelling marker,\textsuperscript{17} the role of ALP as a marker for osteogenic activity has been consistently solidified\textsuperscript{18}; it has been found to be raised merely before the mineralization begins.\textsuperscript{19} Whole saliva is only recently has gained significant recognition as a biologic sample to detect the levels of ALP.\textsuperscript{20} Research has shown that salivary ALP levels when assessed in rats reflect similar patterns of change to those evaluated in serum under normal, diminished or rise condition of systemic turnover of the bone.\textsuperscript{21} The levels increase in salivary ALP reflects destruction and inflammation of healthy tissues proposing it as a dependable and practical biomarker.\textsuperscript{22} The biochemical test by utilizing salivary ALP as a marker in which it may be beneficial as a conceivable marker for turnover of the bone to establish the diagnosis as well as the prognosis of the diseases of periodontium.\textsuperscript{23} The levels of salivary ALP have been measured in correlation with orthodontic tooth movement.\textsuperscript{24} ALP activity has been shown to increase during healing tissue around endosteal implants.\textsuperscript{25} Desai, S, H Shinde, J Mudda, et al. Levels of Alkaline Phosphatase (ALP) In Saliva of Patients with Chronic Periodontitis; a Clinical and Biochemical Study. Internet J Dent Sci.; 8(1): 1937-8238 (2008)

\textbf{Materials and methods}

This prospective clinical study was performed from September 2019 to January 2020. The patients attended the Oral & Maxillofacial Surgery Department in Al-Esraa University College Teaching Hospital/Baghdad for the aim of dental implants placement. The full study was in agreement with the Ethical Committee of Al-Esraa University College, Department of Dentistry. Only straightforward cases, SAC sorting accorded, with two to four teeth replacement were registered in this research with implant placement delayed protocol placement. Orthopantomograph (OPG), A sample of whole unstimulated saliva, and clinical parameters for periodontal health were done for whole patients in this study pre-operatively.

\textbf{Sample Collection}

Samples sterile bottles were coded and grouped to group A and group B for each participant. (5 ml) of un-stimulated whole saliva spitted into the sample sterile bottles, that were directly placed in the bag with ice and imparted to the laboratory for determination of its level of ALP. In the laboratory, the samples were maintained at temp. of -20\degree C and spectrophotometric analytic measurements were carried out within 5 days of collecting the samples.
Forty patients, 30 males and 10 females included in this study who are aged from thirty to forty years old, free of systemic diseases, not subjected to any surgical treatment for at least three months before his/her dental implant surgery, their dental implant number was two to four dental implants per whole mouth, not smokers, and regarding females; they were not pregnant or nursing.

Two non-stimulated salivary samples accumulated from each patient, both of them was 5 ml, one at the day of the surgical procedure ten min. before the beginning of the dental implant surgical procedure and the other ten days after the surgical procedure at the time of suture removal, so the total samples was eighty.

The samples divided to two groups; group A was forty samples for those accumulated before the dental implant surgical procedure and group B which was forty samples also for those accumulated 10 days later.

Each patient received complete periodontal examination of all teeth except 3rd molars on all four surfaces (mesial, distal, buccal, and lingual or palatal)

The dental implant system used was OT medical implant system/Germany

The salivary ALP kit utilized was for BIOMEREIUX/ France.

The dental implants applied was two for twenty patients, three for eight patients, and four for nine patients

**Results**

There was significant difference among group A (at the day of the surgical procedure just ten minutes before the beginning of dental implants surgical part) and group B (ten days after the surgical procedure at the time of suture removal), (P=0.0005) with normal level of salivary ALP for group A and marked increase for group B. The level increase of salivary ALP is directly related to number of dental implants (Table 1).

Statistical analysis:
The SPSS software program version 16 were applied for data analysis, many comparisons for levels of salivary ALP using student T test was done for finding out which group is significantly different.

Coefficient of Pearson's test was used to investigate any correlation between the levels of salivary ALP for both groups
Table 1: Descriptive statistics and groups’ difference for all parameters

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>6.743</td>
<td>0.894</td>
<td>5.3</td>
<td>7</td>
<td>T-test: +12.328</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P value: 0.005</td>
</tr>
<tr>
<td>Group (B)</td>
<td>8.447</td>
<td>1.310</td>
<td>7</td>
<td>10.3</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

It is worthy to say, to better of the authors’ knowledge, that this is the first study in the literature that estimates the salivary ALP test in relation to dental implant surgery. In spite of the large number of studies on the level changes of salivary ALP with periodontitis, up to the present time, we have not found articles in the literature that investigate the changes in the level of salivary ALP in relation to surgical procedure of dental implant as well as the number of dental implants. The process of bone resorption and reformation is of great value for repair and healing of microfractures and to allow modification of the structure in response to stress and other biomechanical forces. This is applied on the surgical procedures of the bone such as the dental implants. Osseointegration is described as an effective interaction between the bony tissue and the dental implant surface. The damaged bone tissue resulting from cutting or drilling the bone for dental implant placement remains in the microenvironment around the dental implant, even after it’s become successfully osseointegrated. The salivary ALP is simple, easy, noninvasive and reliable biomarker for the reflection of the level of bone turnover after dental implant surgical procedure. The results of this study show that the level of salivary ALP is proportionally related to the number of dental implants surgery as there is more bone remodeling after the surgical procedure.
Conclusion

The salivary ALP is a reliable and less invasive biomarker. There is a direct correlation between the number of dental implant and the level of salivary ALP which reveal the level of bone remodeling after the surgical procedure of dental implants.

Reference

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