



Research Article

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Assessment of leptin concentration in peri-implant sulcular fluid during osseointegration of implants: Does it really vary?

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Abstract

Aim: Adequate bone healing is a prerequisite for implant success. Leptin plays an important role in regulating energy balance, increasing the activity of osteoblasts and decreasing the activity of osteoclasts. This study sought to assess the concentration of leptin in peri-implant sulcular fluid (PISF) during the process of osseointegration. **Materials and Methods:** This descriptive study was conducted on 20 patients qualified for implant placement. Samples were obtained from PISF at 10, 30 and 60 days following the placement of implants. A sample was also obtained from the gingival crevicular fluid (GCF) around a sound natural tooth in the opposite quadrant of the same jaw. The implant and the natural control tooth were isolated and samples of the PISF and GCF were obtained by inserting an absorbent paper strip into the sulcus for 30 seconds. Absorbent paper strips were then stored in microtubes at -20°C until the experiment. Samples were analyzed using leptin ELISA kit. Descriptive statistics were computed and the P value was set at .05. **Results:** The patients had a mean age of 45.1±12.6 years (range 21-68 years). The mean concentration of leptin in PISF was 1771.5±694.7 pg/mL at 10, 1675.9±423.9 pg/mL at 30 and 1651.5±608.6 pg/mL at 60 days. The mean concentration of leptin was 1754.9±625.2 pg/mL in GCF of the natural tooth on the day of surgery. **Conclusions:** Although leptin concentration varied and there is some difference in samples, it was not significantly different in PISF at 10, 30 and 60 days post-implantation.

Keywords: Orthognathic surgery, Condylar atrophy, Complications.

INTRODUCTION

Dental implants have facilitated efficient rehabilitation of the masticatory system and provide optimal esthetics. Several types of dental implants have been introduced into the dental market and their success rate has been extensively studied [1-3]. Implant success is a complex concept and depends on several factors. To date, no precise standardized definition has been offered for implant success [4,5]; however, absence of mobility, often indicative of proper osseointegration is regarded as a reliable indicator of implant success [6]. Implant failure is based on many factors and conditions; lack of primary stability and lack of osseointegration are considered to be a major causes of implant failure.

Leptin is a hormone that helps regulate energy balance [7-10]. Leptin acts on receptors in the hypothalamus and affects bone metabolism by increasing sympathetic tone. Increase in concentration of leptin activates the osteoblasts and prevents destructive activity of osteoclasts [11-13]. The biological composition of GCF is often evaluated for assessment of periodontal diseases [14]. Gingival crevicular fluid contains microbial plaque, host immune cells and destroyed tissue cells [15]. Peri-implant sulcular fluid is similar to GCF [16]; the composition of PISF and its correlation with peri-implant conditions have been the subject of

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numerous previous studies [17-20].

This study sought to assess the concentration of leptin in PISF during the process of osseointegration at 10, 30 and 60 days following implant placement and to compare with its concentration in GCF of a sound natural tooth in the opposite quadrant of the same jaw.

MATERIALS AND METHODS

This descriptive study was conducted on patients presenting to the Oral and Maxillofacial Department of our University and a private office in Tehran in 2009. The study was approved by our ethics committee. The inclusion criteria were no cigarette smoking, not use of immunosuppressants, antibiotics, anti-inflammatory drugs and contraceptives in the past three months, no systemic diseases and no premedication for PISF/GCF sampling. The patients were briefed and signed written informed consent form was obtained prior to the study. Demographic information of patients was recorded in a data sheet. Twenty subjects who were indicated for dental implant placement volunteered for the study. Subjects who did not show up for the scheduled appointments for sampling were excluded. Samples were obtained from the PISF at 10, 30 and 60 days after implant placement. A sample was also obtained from the GCF of a sound tooth from the opposite quadrant of the same jaw. Prior to sampling, implant surfaces were dried with air spray to prevent mixing of saliva with the PISF. Dried surfaces were also isolated using cotton rolls. Peri-implant sulcular fluid was collected at the buccal and lingual surfaces of the tooth using sterile absorbent paper strips (Periopaper®, Oraflow, Plainview, NY, USA). The absorbent paper strip was inserted and retained in the sulcus for 30 seconds. During this time period, mechanical stimulation and blood contamination were prevented. Also, all samples were obtained by the same operator to eliminate the human error during sampling. The absorbent paper strips were then transferred into sterile microtubes, frozen and stored at -20°C until analysis.

Analysis of samples. First, 300µL of phosphate buffered saline was added to the microtubes containing the paper strips and the mixture was centrifuged at 1800 rpm for 30 minutes. The prepared solutions were then analyzed for leptin concentration using the human leptin ELISA kit (Avibion Human ELISA, Orgenium Laboratories, Helsinki, Finland) with an assay range of 0-4000 pg/mL. The optical density of wells in each ELISA plate was read at 450 nm wavelength with a reference wavelength of 620nm. Data were analyzed using SPSS version 13 (Microsoft, IL, USA). Paired t-test and Pearson's correlation test were used to compare different concentrations of leptin with a 95% confidence interval (P<0.05 considered statistically significant).

RESULTS

Eighty PISF and GCF samples were obtained from patients referring to our University and a private office in Tehran. The patients had a mean age of 45.1±12.6 years (range 21 to 68 years), mean height of 163.47±18.5 cm (range 150 to 191cm) and mean weight of 78.5±30.5 kg (range 60 to 100 kg). The mean concentration of leptin in the PISF was 1771.5±694.7 pg/mL at 10, 1675.9±423.9 pg/mL at 30 and 1651.5±608.6 pg/mL at 60 days post-implantation. The mean concentration of leptin in GCF around the natural teeth was 1754.9±625.2 pg/mL on the day of surgery (Figure 1). The concentration of leptin in PISF/GCF on the day of surgery and at 10, 30 and 60 days post-operation had no significant correlation with height, weight or sex of patients.

Paired t-test and Pearson's correlation test showed no significant difference in leptin concentration in PISF on the day of surgery and at 10, 30 and 60 days post-implantation. According to Table 1, t-test showed no significant difference in the mean (±standard deviation)

concentration of leptin in PISF/GCF on the day of surgery and at 10, 30 and 60 days post-operation.

Table 1: Comparison of the mean (±standard deviation) concentration of leptin on the day of surgery and at 10, 30 and 60 days post-implantation in males and females

	Sex	Mean	Standard deviation	P value
Leptin concentration on the day of surgery	Females	1441.1	712.3	0.054
	Males	2006.02	431.5	
Leptin concentration 10 days after surgery	Females	2001.6	710.5	0.228
	Males	1604.2	664.9	
Leptin concentration 30 days after surgery	Females	1598.3	500.4	0.594
	Males	1718.2	395.9	
Leptin concentration 60 days after surgery	Females	1683.7	707.2	0.878
	Males	1634.02	584.4	

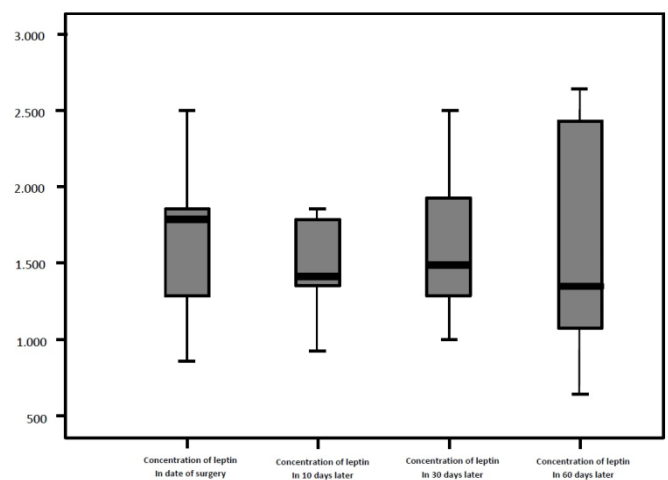


Figure 1: Box plot diagram of leptin concentration on the day of surgery and at 10, 30 and 60 days post-implantation

DISCUSSION

Our study showed that the concentration of leptin did not change significantly at 10, 30 and 60 days after implant placement. Also, comparison of the concentration of leptin in PISF and GCF around a sound tooth in the opposite quadrant of the same jaw revealed no significant difference. The alternative hypothesis of this study was that during the osseointegration, which is a reparative and inflammatory process, concentration of leptin would change in PISF [21].

Johnson *et al*, in 2001 compared the concentration of leptin in healthy individuals and chronic periodontitis patients. Biopsy samples were taken using a scalpel. They found that the concentration of leptin in healthy individuals was higher than that in patients with chronic periodontitis [22]. Yagasaki *et al*, in 2003 evaluated the role of leptin in craniofacial growth of ob/ob mice [23]. They also assessed the leptin receptor gene expression in condylar head cartilage of mice. The results showed that injection of leptin enhanced the craniofacial growth and expression of leptin receptor gene in the condylar head cartilage of mice. Karthikeyan *et al*, in 2007 assessed the concentration of leptin in GCF of patients with chronic gingivitis and periodontitis as well as healthy individuals [24]. In 2007, the same group of researchers evaluated the serum and GCF level of leptin [25]. The results showed lower concentrations of leptin in patients with chronic periodontitis; however, the serum level of leptin in patients with chronic periodontitis was significantly higher than that in the remaining two groups. Dilsiz *et al*, in 2010 evaluated the concentration of leptin in the GCF during orthodontic tooth movement [26].

Recently, it has been suggested that leptin plays an important role in bone regeneration by enhancing the proliferation and differentiation of osteoblasts^[11-13]. Also, it is believed that high concentration of leptin protects the bone surface against inflammation and infection^[27]. Dilsiz *et al.* demonstrated that the concentration of leptin significantly increased 168 hours after load application to teeth. This is probably due to the resorption and deposition of bone during orthodontic tooth movement^[26]. Bone resorption and deposition also occur during the process of osseointegration. Thus, we expected a rise in the concentration of leptin during the process of osseointegration. However, this was not the case.

Resimbozkurt *et al.*, in 2006 evaluated the concentration of leptin in GCF of heavy smokers^[28]. They showed that high concentration of leptin in GCF collected from the healthy gingival tissues of periodontal patients might serve a protective role. Gingiva in smokers suffer from chronic periodontitis, which is an inflammatory condition. Osseointegration is also believed to be an inflammatory process. Thus, concentration of leptin is expected to increase during osseointegration. Um *et al.*, in 2012 evaluated the role of leptin as an important mediator in differentiation of dental mesenchymal stem cells^[29].

Nokhbeh *et al.*, in 2014 investigated the effect of leptin on regeneration capacity of human periodontal cells^[30]. Li *et al.*, in their animal study in 2014 demonstrated that leptin plays a role in mineralization of teeth and angiogenesis of periodontal tissues^[31]. Since gingivitis and periodontitis are considered to be inflammatory processes, and that the concentration of leptin increases during inflammation^[32-34], logically, leptin concentration should increase in PISF during osseointegration, which is an inflammatory process. However, in the above-mentioned studies, the concentration of leptin decreased in local inflammatory processes.

CONCLUSION

Within the limitations of this study, it is concluded that leptin is present in PISF and GCF; but its concentration does not significantly change at 10, 30 and 60 days after implant placement. Moreover, no significant difference was found in the concentration of leptin in GCF around a healthy natural tooth and PISF at 10, 30 and 60 days post-implantation. Considering the important role of leptin, further studies are required to more accurately assess the possible changes in its concentration during the process of osseointegration.

Conflict of interest: None.

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