

## Biomechanical effect of one session of low-level laser on the bone–titanium implant interface

Carolina Boldrini · Juliano Milanezi de Almeida ·  
Leandro Araújo Fernandes · Fernando Salimon Ribeiro ·  
Valdir Gouveia Garcia · Letícia Helena Theodoro ·  
Ana Emilia Farias Pontes

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**Abstract** Low-level laser (LLL) has been used on peri-implant tissues for accelerating bone formation. However, the effect of one session of LLL in the strength of bone–implant interface during early healing process remains unclear. The present study aims to evaluate the removal torque of titanium implants irradiated with LLL during surgical preparation of implant bed, in comparison to non-irradiation. Sixty-four Wistar rats were used. Half of the animals were included in LLL group, while the other half remained as control. All animals had the tibia prepared with a 2 mm drill, and a titanium implant (2.2×4 mm) was inserted. Animals from LLL group were irradiated with laser (gallium aluminum arsenide), with a wavelength of 808 nm, a measured power output of 50 mW, to emit radiation in collimated beams (0.4 cm<sup>2</sup>), for 1 min and 23 s, and an energy density of 11 J/cm<sup>2</sup>. Two applications (22 J/cm<sup>2</sup>) were performed immediately after bed preparation for implant installation. Flaps were sutured, and animals from both groups were sacrificed 7, 15, 30, and 45 days after implant installation,

when load necessary for removing implant from bone was evaluated by using a torquimeter. In both groups, torque values tended to increase overtime; and at 30 and 45 days periods, values were statistically higher for LLL group in comparison to control (ANOVA test,  $p < 0.0001$ ). Thus, it could be suggested that a single session of irradiation with LLL was beneficial to improve bone–implant interface strength, contributing to the osseointegration process.

**Keywords** Dental implants · Low-level laser therapy · Osseointegration · Torque · Animal models

### Introduction

Titanium implants are widely used in Dentistry and Medicine to support dental and orthopedic prosthesis. A predictable way to reach long-term clinical success of such devices is to achieve an intimate contact between living bone and implant, known as osseointegration [1, 2].

Multiple postoperative sessions of low-level lasers (LLL) application in peri-implant tissues not only stimulates local blood circulation and bone–implant contact surface area, but also accelerates bone maturation [3, 4].

Alternatively to multiple sessions, a single LLL session protocol has been proposed to improve time-saving convenience for patient as well as professional staff. After its use in peri-implant area, higher quantity of viable osteocytes [5], higher metabolic bone activity [6], higher bone–implant contact values and hardness nearby implant [3] were observed on irradiated sites in comparison to control.

However, the effect of LLL in the strength of bone–implant interface and the dynamic of its formation during

C. Boldrini · F. S. Ribeiro · V. G. Garcia · A. E. F. Pontes (✉)  
Master of Science Course, Educational Foundation of Barretos,  
UNIFEB,  
Rua Prof. Roberto Frade Monte 389, Bairro Aeroporto,  
14783-226 Barretos, SP, Brazil  
e-mail: anaemiliapontes@yahoo.com.br

L. A. Fernandes  
School of Dentistry, Federal University of Alfenas, UNIFAL,  
Rua Gabriel Monteiro da Silva, 700, Bairro Centro,  
37130-000 Alfenas, MG, Brazil

J. M. de Almeida · L. H. Theodoro  
Group of Study and Research on Laser in Dentistry, GEPLD,  
Department of Surgery and Integrated Clinic, Division of  
Periodontics, São Paulo State University, UNESP,  
Rua José Bonifácio, 1193, Bairro Vila Mendonça,  
16050500 Aracatuba, SP, Brazil