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Original Article

# Occurrence of trigeminocardiac reflex during dental implant surgery: An observational prospective study

James I-Sheng Huang<sup>a</sup>, Hui-Chieh Yu<sup>a</sup>, Yu-Chao Chang<sup>a,b,\*</sup><sup>a</sup> School of Dentistry, Chung Shan Medical University, Taichung, Taiwan<sup>b</sup> Department of Dentistry, Chung Shan Medical University Hospital, Taichung, Taiwan

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**KEYWORDS**Trigeminocardiac reflex;  
Hemodynamic alterations;  
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Prospective study

**Background/Purpose:** Trigeminocardiac reflex (TCR) is a clinical phenomenon that manifests as a sudden onset of hemodynamic perturbations. TCR has been reported in cranio-maxillofacial surgery resulting in severe medical risks. Monitoring the hemodynamic changes during cranio-maxillofacial surgery can provide important information to ensure the continuous evaluation of patient's physical conditions. This prospective observational study was conducted to determine the hemodynamic alterations related to the possibly of occurrence of TCR in patients during dental implant surgery.

**Methods:** One hundred and thirty-five patients (69 males and 66 females) received dental implant placement were enrolled in this study. The hemodynamic changes were evaluated by monitoring heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse oximetry (SpO<sub>2</sub>). The above data were collected before, during, and after dental implant surgery.

**Results:** The data demonstrated that the minimal values of HR, SBP, and DBP as well as MABP decreased significantly during operation comparing with the corresponding values before operation ( $p < 0.0001$ ). In addition, HR and SBP decreased significantly in post-operation stage comparing with the corresponding values in pre-operation stage ( $p < 0.0001$ ). Comparing to dental implant placement in the mandible, patients received dental implant placement in the maxilla had more risks to confront with MABP reduction (OR = 3.98; 95% confidence interval: 1.12–13.2).

**Conclusion:** A significant HR and BP reduction possibly due to TCR can occur during dental implant surgery. Therefore, the dentists should monitor the hemodynamic changes during dental implant surgery to prevent the possible occurrence of medical risks related to TCR.

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\* Corresponding author. School of Dentistry, Chung Shan Medical University, 110, Sec. 1, Chien-Kuo N. Rd., Taichung, Taiwan. Fax: +886 4 24759065.

E-mail address: [cyc@csmu.edu.tw](mailto:cyc@csmu.edu.tw) (Y.-C. Chang).

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## Introduction

Sudden heart rate (HR) or mean arterial blood pressure (MABP) decreased during surgical manipulation have been reported during cranio-maxillofacial surgeries,<sup>1–4</sup> even bradycardia progressed to a cardiac asystole during mid-face manipulation was reported.<sup>4</sup> Interestingly, bradycardia was also found during tooth extraction procedure.<sup>5</sup> This phenomenon could be the so-called trigeminocardiac reflex (TCR), an unique brain stem reflex consisting of a sudden onset of HR and MABP decreased that may consequently develop asystole and even cardiac arrest, which was first found by Guiesepe & Arscher in 1908 and described in detail by Schaller et al.<sup>6</sup> Therefore, it may be important to advise dentist to take into account monitoring the principal vital signs, circulatory, respiratory, blood pressure (BP), HR, and pulse oximetry (SpO<sub>2</sub>) during dental procedures especial for surgical or invasive managements.

Therefore, monitoring patient during the dental implant surgery is advisable when the surgical procedure is expected to be traumatic or if the patient's psychological condition makes such control desirable to optimize safety. Monitoring of vital signs during dental care allows the dentists to detect the potential risks on such situations: before surgical procedure, evaluation in early diagnosis, prevention of possible complications, and operation with safety.<sup>7</sup> However, little is known about the during dental implant procedures.

In this study, we recorded the changes of systolic blood pressure (SBP), diastolic blood pressure (DBP), HR, and SpO<sub>2</sub> to determine the hemodynamic alterations in patients during dental implant surgery performed with local anesthetic agents. In addition, we further analyzed the influences of gender, age, and the location of implant placement focused on the hemodynamic instability related to TCR including bradycardia and hypotension on patients.

## Materials and methods

After approval by the Institute Review Board, Chung Shan Medical University Hospital (protocol# CSMUH No.CS14112), a prospective observational study without intervention was conducted in the usual implant placement of the patients. This monocentric clinical study was made of 135 healthy patients (69 males and 66 females) without any systemic disease who received implant placement with informed consent between February 2015 and August 2016.

The hemodynamic changes were evaluated by the CRITICARE Model 506 series monitor (Criticare Systems Inc., Waukesha, Wisconsin, USA). The levels of SBP, DBP, HR, and SpO<sub>2</sub> were recorded of all patients prior to the injection of local anesthetic agents. Up to two cartridges of 4% articaine in 1.7 ml cartridges with an epinephrine concentration of 1:100,000 Ubistesin™ forte (3M ESPE, Seefeld, Germany) was used through local infiltration injection to obtain local anesthesia. Dental explorer was used to ensure proper anesthesia before surgery. All the dental implant placements were performed by one specialty (Dr. Huang) and care was exerted to avoid excess trauma or inadequate anesthesia during incision, mucoperiosteal flap reflection, drilling, implant placement, and final suture. Both HR and

BP were registered every minute during the dental implant surgery. Four values were collected: (1) before commencing surgery (pre-operation), (2) the minimum and maximum values during local anesthetic injection, incision and raising a mucoperiosteal flap, drilling, implant placement, and finally at suturing (during operation), (3) the completion (post-operation). The MABP was determined using measured values of SBP and DBP and was defined as  $1/3 \text{ SBP} + 2/3 \text{ DBP}$ .

## Statistical analysis

Statistical package of social sciences software (version 21.0) (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis. Chi-square or Fisher's exact test was applied where appropriate in Table 1 to determine statistical the significance of differences between age, gender, implant number, and region. The means and standard deviations (SD) were calculated and paired t test was used to determine statistical significance of the differences pre-operation, operation, and post-operation in Table 2. Odds ratio (OR) in Table 5 was calculated by binary logistic regression analysis between groups; p values less than 0.05 were considered statistically significant.

## Results

The demographic characteristics of total of 135 patients receiving dental implant placement is shown in Table 1. There were 69 (51.1%) males and 66 (48.9%) females with mean age  $56.5 \pm 12.4$  years old. The areas of implant placement were 60 in maxilla and 75 in mandible. Distribution of locations of dental implant placement was revealed in Table 1. There are no significant difference among age, gender, and implant number ( $p > 0.05$ ).

As shown in Table 2, monitored data demonstrated that the minimum values of HR, SBP, DBP, and MABP decreased significantly during implant placement comparing with values before implant placement ( $p < 0.0001$ ). However,

**Table 1** The comparisons of demographic characteristics of patients received implant placement.

	Total (n = 135)	Maxilla (n = 60)	Mandible (n = 75)	p-value
Age (y/o)	$56.5 \pm 12.4$	$58.0 \pm 13.6$	$55.3 \pm 11.3$	0.22
Gender				
Male	69 (51.1%)	33 (55.0%)	36 (48.0%)	0.42
Female	66 (48.9%)	27 (45.0%)	39 (52.0%)	
Implant number	$1.5 \pm 0.7$	$1.5 \pm 0.7$	$1.6 \pm 0.7$	0.41
Region				
Anterior	12 (8.9%)	9 (15.0%)	3 (4.0%)	0.03
Posterior	123 (91.1%)	51 (85.0%)	72 (96.0%)	

Chi-square test or Fisher's exact test was applied where appropriate to determine the statistical significance of differences between age, gender, implant number, and region. The level of statistical significance was set at 0.05.

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