



## Association between Food Impaction and Peri-implant Soft Tissue Condition at Proximal Space between Implant Supported Single Crown and Natural Teeth

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### Abstract

The purpose of this study was to investigate the association of food impaction at proximal space between implant-supported single crown (ISSC) and natural teeth and peri-implant soft tissue condition. Patients with ISSC coming for implant checkups at the Faculty of Dentistry, Chulalongkorn University between July 2019 and December 2019, were recruited. Food impaction was evaluated by either patients' experience or clinical examination of food wedging in the proximal space. Peri-implant soft tissue inflammation was recorded when there was bleeding on probing (BOP) at the ISSC site. Also, proximal contact tightness, level of papilla appearance, plaque presence, pocket depth, and keratinized mucosa width were assessed. The association between food impaction and the presence of BOP was analyzed by the Chi-square test and considered significant at  $P < 0.05$ . A total of 302 proximal spaces of 215 ISSC in 132 patients were examined. Among 302 proximal spaces, contact tightness, level of papilla appearance, plaque presence, and keratinized tissue width found no association with BOP. However, there was a significant association between probing depth and BOP ( $P < 0.001$ ). However, BOP was not associated with food impaction ( $P = 0.864$ ). In conclusion, food impaction between ISSC and natural teeth peri-implant soft tissue inflammation was not associated with peri-implant soft tissue inflammation.

**Keywords:** Food impaction, Bleeding on probing, Dental implant, Peri-implant soft tissue inflammation, Implant supported single crown.

### 1. Introduction

In recent years, dental implants have been widely used to restore complete and partially edentulous patients with high survival rates (Howe, Keys & Richards, 2019; Moraschini, Poubel, Ferreira & dos Sp Barboza, 2015). Masticatory function, satisfaction, and quality of life are reportedly improved with implant prostheses (Jofre, Castiglioni & Lobos, 2013; Tang, Lund, Tache, Clokie & Feine, 1999; Topçu et al., 2017; Zhang, Lyu, Shang, Niu & Liang, 2017). However, complications were reported regarding esthetic, technical, and biological aspects. Technical complication such as crown chipping, screw loosening or fracture, implant fracture, mechanical retention problem was found in follow up period. Inflammation of peri-implant tissues, namely peri-implant mucositis and peri-implantitis, were examples of biological complications (Cooper, De Kok, Thalji & Bryington, 2019; Pjetursson, Thoma, Jung, Zwahlen & Zembic, 2012).

Peri-implant inflammation was caused by the accumulation of bacterial biofilm surrounding the dental implant. The peri-implant disease was classified into peri-implant mucositis and peri-implantitis. Compare to periodontal disease, peri-implant mucositis was similar to gingivitis, which is an inflammation of soft tissue. While peri-implantitis was compared to periodontitis, which is an inflammation involving bone loss. According to the World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions in 2018, peri-implant mucositis was considered whether there is soft tissue inflammation, for instance, swelling, redness, bleeding on probing (BOP) with gentle probing. Also, Peri-implantitis was defined when there is inflammation of soft tissue and radiographic bone loss (Berglundh et al., 2018; Renvert, Persson, Pirihi & Camargo, 2018).

Besides, food impaction between the implant and natural tooth was claimed after implant restoration (Wat, Wong, Leung & Pow, 2011). Food impaction created a favorable area for bacteria growth (Prichard, 1960). Proximal contact open and lack of interproximal papilla were associated with food impaction (Byun, Heo, Ahn & Chang, 2015; Gastaldo, Cury & Sendyk, 2004). Although proximal contact tightness between



the implant restoration and natural tooth was well constructed, it could change (Wat et al., 2011). The changes were reported to occur at three months following restoration delivery (Ren, Lin, Hu & Wang, 2016). The mesial drift of natural teeth in relation to ankylosing of implant alters the proximal contact tightness (Heij et al., 2006; Wat et al., 2011). Proximal contact loss was reported more in the mesial aspect (Varthis, Randi & Tarnow, 2016). Loss of proximal contact has been found to be a factor inducing food impaction and peri-implant pathology (Bidra, 2014; Dörfer, Von Bethlenfalvy, Staehle & Pioch, 2000). Patient satisfaction has been reported to decrease due to food impaction (Jeong & Chang, 2015).

To the best of our knowledge, there are few studies about the association of food impaction between implant-supported single crown (ISSC) and peri-implant soft tissue inflammation. Therefore, this study aimed to assess the association of food impaction between ISSC and natural teeth on peri-implant soft tissue inflammation.

## 2. Objectives

To assess the association of food impaction between ISSC and natural teeth and peri-implant soft tissue inflammation.

## 3. Materials and Methods

### 3.1 Study sample

This study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University, and is a cross-sectional descriptive study. Patients with ISSC coming for implant checkups at the Faculty of Dentistry, Chulalongkorn University, between July 2019 and December 2019, were included in this study. Participants who had premolar or molar ISSC more than three months of loading and adjacent natural teeth at least one proximal contact were evaluated.

### 3.2 Data collection

Food impaction at proximal space was evaluated by both subjective (the participants) and objective (clinicians). Participants were asked if they have encountered food impaction between ISSC and natural teeth and further confirmed the proximal space having food impaction in their oral. Clinicians also evaluated food impaction if there is food wedging in the proximal space by using dental floss. Food impaction in the proximal space was recorded as “yes” when the participants answer that there was food impaction, or the clinicians examine that there was food impaction (Varthis et al., 2016). Proximal contact tightness between ISSC and natural teeth was also assessed by dental floss and classified as 1) “very tight” when dental floss cannot pass or got tear after flossing, 2) “tight” if there is definite pressure, 3) “loose” for minimal pressure, and 4) “open” for no pressure. Due to a few numbers of loose and open contact, they were grouped into a “loose” group. The level of papilla fill in the proximal space was determined by the papilla index scoring system (Jemt, 1997) and scored as 0\_no papilla fill, 1\_less than half of the height of papilla presence, 2\_half or more of the height of papilla presence and 3\_entire papilla fill. Because of a small number in papilla scores of 0 and 1, they were combined as a group of less than half of the papilla height presence. The BOP after probing with light pressure was used to assessed peri-implant soft tissue inflammation. In addition, pocket depth and keratinized mucosa width were measured by periodontal probe with 1mm marking. Plaque presence at ISSC were recorded. Participants’ age, gender, ISSC’s position, location, time after loading (function time), and proximal space were also noted.

### 3.3 Statistic analysis

Descriptive data were reported in number, percentage, mean, standard deviation, and range. The association between food impaction and BOP of ISSC was analyzed by the Chi-square test, while the Mann-Whitney U test was used to analyzed quantitative data due to abnormal distribution. Data analysis was performed by SPSS version 22 (IBM Corp., Armonk, NY, USA) and considered significant when the p-value is less than 0.05.



## 4. Results and Discussion

### 4.1 Results

Totally 132 patients, age 25-88 years (mean 55.6 years), were included in this study. The characteristic of the participants was shown in table 1. It was found that the proportion of females is greater than males, with 56.8% and 43.2%, respectively. There were 215 ISSC, and most of them were placed in the molar and mandible position. Among 302 proximal spaces, 174 (57.6%) were in mesial and 128 (42.4%) in distal. The mean function time after crown insertion was 26.63 months (range 3-168 months).

**Table 1** Study samples description

Characteristic	Number	Percentage
<b>Gender</b>	132	
Male	57	43.2
Female	75	56.8
<b>Age</b>		
Mean $\pm$ SD)	55.6 $\pm$ 12.03 years	
Range	25-88	
<b>Implant-supported single crowns</b>	215	
<b>Position</b>		
Premolar	36	16.7
Molar	179	83.3
<b>Location</b>		
Maxilla	65	30.2
Mandible	150	69.8
<b>Proximal space</b>	302	
Mesial	174	57.6
Distal	128	42.4
<b>Food impaction</b>		
Yes	240	79.5
No	62	20.5
<b>Function time</b>		
Mean $\pm$ SD	26.63 $\pm$ 22.19	
Range	3-168 months	

There were 50 proximal spaces having food impaction with BOP, while 192 proximal spaces reported food impaction with no BOP. However, there was no significant association between BOP and food impaction ( $P=0.864$ ), as shown in Table 2. Besides of proximal contact tightness, level of papilla fill, keratinized mucosa width, and plaque presence were found no association with BOP. Nevertheless, probing depth was shown to be associated with BOP ( $P<0.001$ ), as demonstrated in Table 3.

**Table 2** Association between peri-implant inflammation and food impaction

	Bleeding on probing		No bleeding on probing		P-value
	N	%	N	%	
<b>Food impaction</b>					0.864
Yes	50	16.6	192	63.6	
No	13	4.3	47	15.6	

**Table 3** Association between bleeding on probing and related factors

	Bleeding on probing		No bleeding on probing		P-value
	N	%	N	%	
<b>Contact tightness</b>					0.58
Very tight	5	1.7	20	6.6	
Tight	43	14.2	176	58.3	
Loose	15	5.0	43	14.2	
<b>Papilla fill</b>					0.335
<1/2 of the papilla height	10	3.3	23	7.6	

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	Bleeding on probing		No bleeding on probing		P-value
	N	%	N	%	
>1/2 of the papilla height	5	1.7	25	8.3	
Entire papilla fill	48	15.9	191	63.2	
<b>Pocket depth (mm±SD)</b>	2.30±0.87		2.92±1.25		0.000*
<b>Keratinized mucosa width (mm±SD)</b>	2.32±1.48		2.32±1.48		0.927
<b>Plaque</b>					0.062
Yes	11	3.6	22	7.3	
No	52	11.2	217	71.9	

\*\_P < 0.001

#### 4.2 Discussion

In this study, food impaction was reported 80% of proximal space between ISSC and natural teeth. According to previous studies, it was reported 44.7% (Jeong & Chang, 2015) and 40% (Varthis et al., 2016) of food impaction, which is lower than the result of this study. Unremovable food impaction in the proximal space would induce peri-implant or periodontal tissue inflammation. Thus, from the result, 50 proximal space (16.6%) was found food impaction with BOP. It was higher than the study of Jeong & Chang (2015) with 11.5%. However, the result was supported by prior study (Jeong & Chang, 2015) that food impaction is not associated with peri-implant inflammation.

From the result, proximal contact loose was found nearly 20%, while other studies were found higher than the present study with 34% (Byun et al., 2015) and 52.8% (Varthis et al., 2016), respectively. Different diameters and types of dental floss might lead to different outcomes. Proximal contact loose should be evaluated with definite quantitative measurements to be more concise and comparable.

Most of the proximal space did not found peri-implant soft tissue inflammation with no BOP. Probing depth was found a significant association with BOP. Moreover, force or angulation of probing, the diameter of the probe, and implant placement would be factors affecting probing depth measurement (Salvi & Lang, 2004). Only 10.9% of proximal space had plaque presence. In this study, the plaque was assessed as a dichotomous variable; quantitative measurement should be used to be more reliable. Plaque score and gingival index score should be applied to assessed peri-implant tissue inflammation in further studies.

The limitation of this study is the design of a cross-sectional study. Prospective study design should be performed in order to investigate if the proximal contact change affects the inflammation of implant-supported tissues. Moreover, other contributing factors, such as opposing dentition, the accessibility for cleaning, patient's attitude, and systemic disease, should be analyzed.

#### 5. Conclusion

In conclusion, food impaction is commonly found after dental implant restoration. However, food impaction between ISSC and natural teeth was not associated with peri-implant soft-tissue inflammation.

#### 6. Acknowledgments

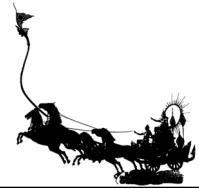
There was no conflict of interest in this study.

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