

A Study on the Screw Loosening of Implants Having Different Connection Methods in Repeated Measurements

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Abstract

This study carried out screw loosening tests for the purpose of evaluating differences of screw loosening torque through 5-times repeated measurement on screw loosening tests about fixture and abutment after fixing 4-kind implant (N=4) fixture and abutment having different tightening methods by using an electric torque meter (SMTT03-50, MARK-10, UA) and fixing them with fixed screws of 30N·cm. From all of internal octagon connection implant and external hexagon connection implant, internal hexagon connection implant having morse taper of 11° and 1.5°, screw loosening values were decreased as much as the measuring times were increased.

Keywords: Dental Implant, repeated measures, screw, Screw Loosening

1. Introduction

Implant prosthetic therapy methods that improved problems in using manufacturing methods of traditional dentist prosthesis are showing high success rate clinically. However, problems in failure owing to inflammation occurrence from tissues around implant, fractures of the structure like implant screw, abutment, and fixture, and mechanical matters on screw loosening are being reported [1][2][3].

Lekholm and others reported problems of loose screws and fractures of resin, even though implant success rate of the upper and lower jaw from tracing surveys for 5 years was 94% [4]. Wennerberg and Jemit reported problems of loosening occurrences of implant screws from 13% patients together with fracturing matters from 5% patients, though accumulating survival rate of people who had prosthesis for 5 years [5], and Preiskel and Tsolka made a report on problems of implant screw fractures in a survey regarding implant therapy results for 10 years too [6].

Such screw loosening problems of implant prosthesis can be influenced from contacts with implant connection parts, mechanical nature according to kinds of metal materials etc [7]. To sustain implant prosthesis stably, suitable clamping force is necessary for designs on implant fixed screws and long fatigue life [8]. In the research of screw loosening in upper prosthesis that is supported by majority implants, 1st clamping with final clamping torque and 2nd method of clamping with same force again after 10 minutes were stable because screw loosening torque value was higher rather than 1st step method which was tightened once with final clamping torque [9].

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Methods of compensating full load loss by surface subsidence of implant clamping parts occurred after initial clamping force are being used clinically by tightening fixed screws to abutment and fixture when clamping and fixing implant, and giving same force again after 10 minutes.

This study was carried out to evaluate differences of screw loosening by executing screw loosening tests and measuring same tests 5 times repeatedly after clamping and fixing 4-kind implant fixtures and abutments having different clamping methods, and then to apply the results to oral health datum.

2. Related researches

2.1. Test method

Implants having been used for tests object total 4-kind implant fixture and implant abutment having different clamping methods such as Internal octagon connection Implant (YI Implant, Yesbiotech, KOREA)(N=4), External hexagon connection Implant (YE Implant, Yesbiotech, KOREA)(N=4), Internal hexagon connection implant having morse taper of 11° and Internal hexagon connection implant (A&B Implant, A&B Biomed, KOREA)(N=4) having morse taper of 1.5°.

Each specimen size of implant fixture and abutment, it objects total 16 implant fixtures and abutments by selecting similar sizes by clamping types (Table 1).

Total 4-kind implant fixtures and abutments were fixed after clamping and fixing first by using electric torque measurer (SMTT03-50, MARK-10, USA) with 30N·cm, and then fixing was made with same force after 10 minutes. Screw loosening tests were carried out by executing the tests and measuring to 0.1 N·cm unit after clamping and fixing. Such screw loosening tests were executed total 5 times repeatedly (Figure 1).

2.1.1 Analysis of test results

Results of screw loosening tests on measured 4-kind implant fixtures and abutments to 5 times in this research, and comparison was made by using linear graph and remarking them.

Table 1. 1 4-kind implant specimen sizes (mm)

Implant type		Ø	length
YI	Fixture	4.0	10
	Abutment	4.8	5.7
YE	Fixture	4.0	10
	Abutment	4.0	5.0
YS	Fixture	4.0	10
	Abutment	4.5	5.5
A&B	Fixture	4.0	10
	Abutment	4.5	5.5

YI: Internal octagon connection

YE: External hexagon connection Implant

YS: Internal hexagon connection Implant having morse taper of 11 °

YZ: Internal hexagon connection Implant having morse taper of 1.5 °



Figure 1. Implant screw loosening test

3. Results

As a result of screw loosening tests of 5 times repeatedly after clamping and fixing Internal octagon connection implant with 30N·cm, screw loosening torques were decreased as much as tests were repeated from 1st 29.7N·cm to 3rd 29.2N·cm, and 5th 28.5N·cm in No.1 specimen, and the highest screw loosening results appeared. Regarding No.2 specimen, screw loosening torques were decreased from 1st 28.5N·cm to 3rd 28.5N·cm and 5th 27.5N·cm, and the lowest screw loosening results were displayed (Figure 2).

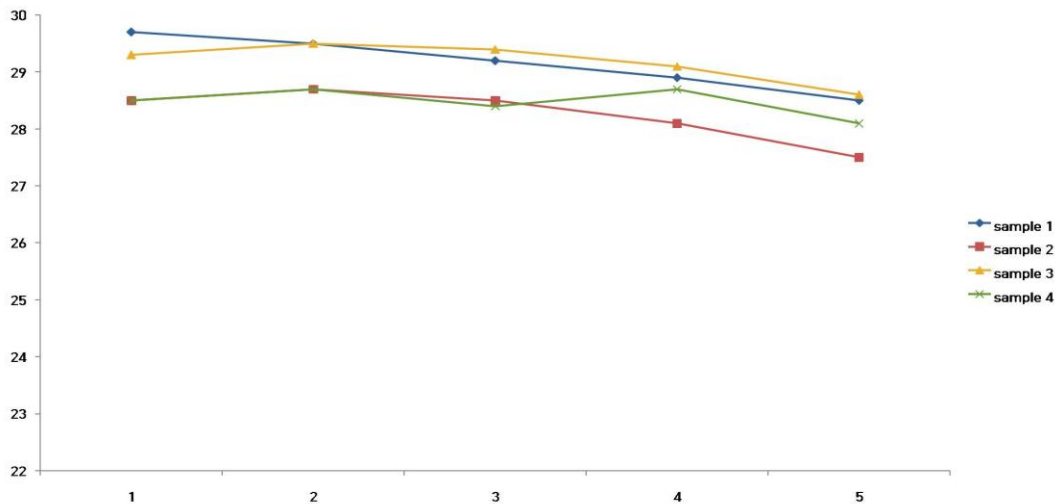


Figure 2. Screw loosening test of internal octagon connection implant (N·cm)

As a result of screw loosening tests by repeating 5 times after clamping and fixing External hexagon connection implant with 30N·cm, and screw loosening torques of No.4 implant specimen were decreased as much as tests were repeated from 1st 27.5N·cm to 3rd 27.1N·cm and 5th 26.8N·cm, and the highest screw loosening results were come out. In relation with No.3 implant specimen, screw loosening torques were decreased as much as tests were repeated from 1st 26N·cm to 3rd 25.6N·cm and 5th 24.8N·cm, and the lowest screw loosening results were turned out. (Figure 3).

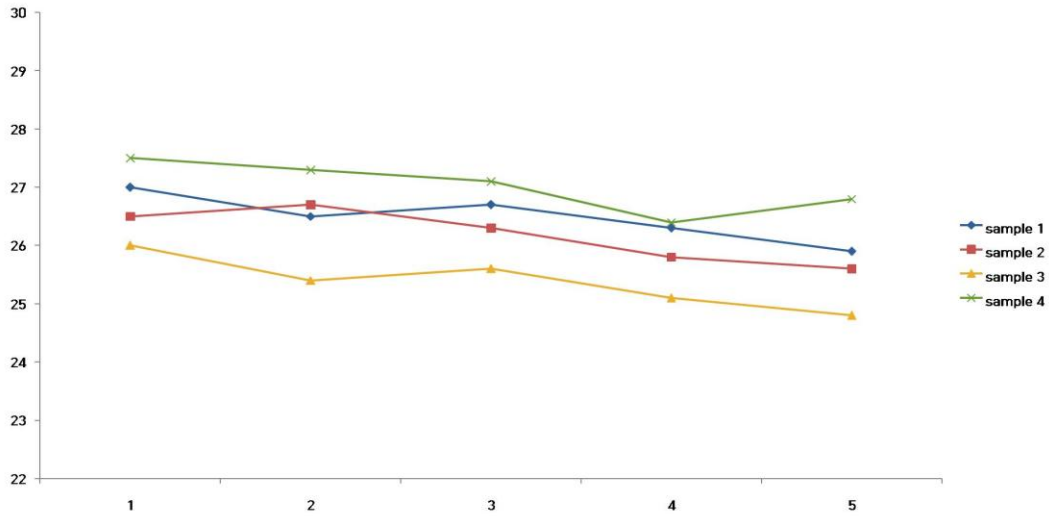


Figure 3 Screw loosening test of external hexagon connection implant having submerged type (N·cm)

As a result of doing 5-times screw loosening tests after clamping and fixing Internal hexagon connection implant having morse taper of 11° after clamping and fixing it with $30\text{N}\cdot\text{cm}$, screw loosening torques were decreased as much as tests were repeated from 1st $24.6\text{N}\cdot\text{cm}$ to 3rd $24.4\text{N}\cdot\text{cm}$ and 5th $24.2\text{N}\cdot\text{cm}$, and the highest screw loosening results were come out. Screw loosening torques of No.5 implant specimen were decreased in screw loosening torques from 1st $24.3\text{N}\cdot\text{cm}$ to 3rd $24.2\text{N}\cdot\text{cm}$ and 5th $23.4\text{N}\cdot\text{cm}$, the lowest screw loosening results were displayed (Figure 4).

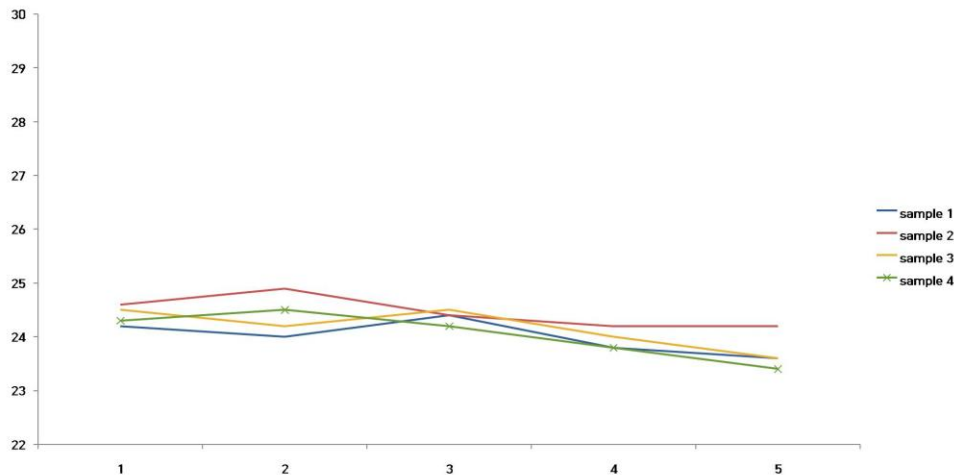


Figure 4. Screw loosening test of Internal hexagon connection implant having morse taper of 11° (N·cm)

As a result of screw loosening test results repeated 5 times after clamping and fixing Internal hexagon connection implant having morse taper of 1.5° , screw loosening torques of

No.2 implant specimen were decreased from 1st 24.5N·cm to 3rd 24.1N·cm and 5th 24.2N·cm as much as tests were repeated, and the highest screw loosening results appeared. Regarding No.5 specimen, screw loosening torques were decreased from 1st 22.5N·cm to 3rd 22.5N·cm to 5th 22.1N·cm as much as tests were repeated, and the lowest screw loosening results were turned out (Figure 5).

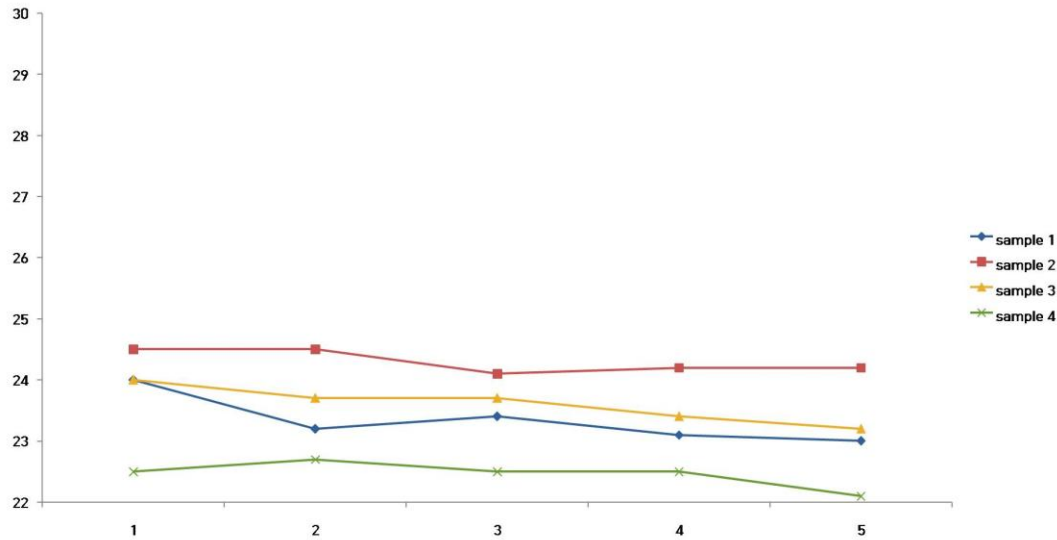


Figure 5. Screw loosening test of internal hexagon connection implant having morse taper of 1.5° (N·cm)

4. Discussion and conclusions

This study carried out screw loosening tests 5 times repeatedly by using electrical torque measurer (SMTT03-50, MARK-10, USA) after clamping and fixing fixtures and abutments with 30N·cm by objecting 4-kind implants having different clamping methods.

In this study, all specimen having been used for 5-times repeated measurement tests on 4-kind implant fixtures and abutments were investigated as being higher than 22.5N·cm of test standard specifications regarding implant screw loosening torque tests for the dentist having medical device standard specifications from Korea Food and Drug Administration.

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