

# A 12-year retrospective study of implant component fracture

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## Abstract

### Background

There have been several studies on fracture of the implant components, most studies report only failure of the osseointegration and it is overlooked that implant failure can be caused by implant component fracture. Clinically, in the case of implant abutment fracture or screw fracture, it is recommended to remake the prosthesis after removing the fractured remnant, however, it is difficult to remove the fragments and eventually the implants must be removed, leading to failure.

### Aim/Hypothesis

The aim of this study was to predict the prognosis of implants and to suggest directions for successful implant treatment by analyzing the factors affecting the fracture of implant components including abutment connection type, implant location and implant platform size.

### Materials and Methods

Data were collected from the clinical records of all patients who received one or more WARANTEC implants at Seoul National University Dental Hospital from February 2002 to January 2014 for 12 years. Data collection included 406 patients (205 males, 201 females), ranging in age from 21 to 94 years (mean 64.6 years, SD 11.5). Total number of implants were 1,289 and an average of 3.2 implants were installed per patient. Information about abutment connection type (internal or external), implant locations, platform sizes was collected with presence of implant component fractures and their managements. The information about implant component fractures was divided into three types: screw fractures, abutment fractures, and fixture fractures. The management of fractures was classified as screw replacement, prosthesis refabrication, and fixture removal. SPSS statistics software (version 24.0, IBM) was used for the statistical analysis.

### Results

Overall fracture was significantly more frequent in internal type. The most frequently fractured component was abutment in internal type implants, and screw fracture occurred most frequently in external type. The most frequent location which implant component fractures occurred was the maxillary posterior region in internal type, and maxillary anterior region in external type. Analyzing by fractured components, screw fracture was the most frequent in the maxillary anterior region and the most abutment fracture occurred in the maxillary posterior region significantly. There was significant relationship between platform size and fractures. In external type, the number of fractures of NP was larger than that in other platform sizes, and more fractures occurred in the RP than other platform sizes in internal type. Analyzing by fractured components, screw fractures occurred more frequently in NP (narrow platform) and abutment fractures occurred more frequently in RP (regular platform).

### Conclusion and clinical implications

In external type, screw fracture occurred most frequently, especially in the maxillary anterior region, and in internal type, abutment fracture occurred frequently in the posterior region. The screw fracture seems to be easier to solve than the abutment fracture. Therefore, placement of an external type implant rather than an internal type is recommended for the posterior region where abutment fractures frequently occur.

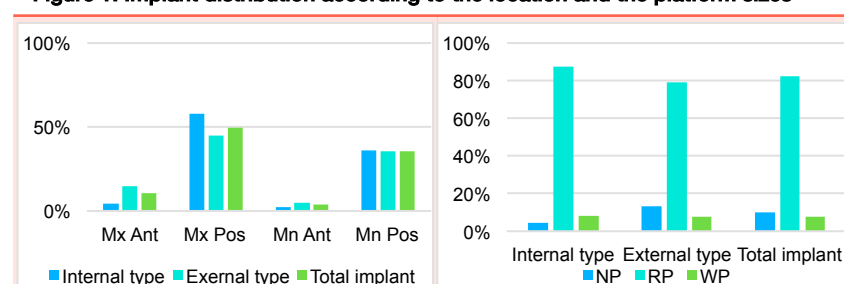
## Methods and Materials

Data were collected from the clinical records of all patients who received one or more WARANTEC implants at Seoul National University Dental Hospital from February 2002 to January 2014 for 12 years and the following cases were excluded: i) implants failed in osseointegration, ii) implant placement after jaw resection and reconstruction, iii) the opposite arch was complete denture, iv) implant assisted over denture, v) insufficient clinical chart recording, vi) patients who have not visited since 2012. Data collection included 406 patients (205 males, 201 females), ranging in age from 21 to 94 years (mean 64.6 years, SD 11.5). Total number of implants were 1,289 and an average of 3.2 implants were installed per patient.

### Statistical Analysis

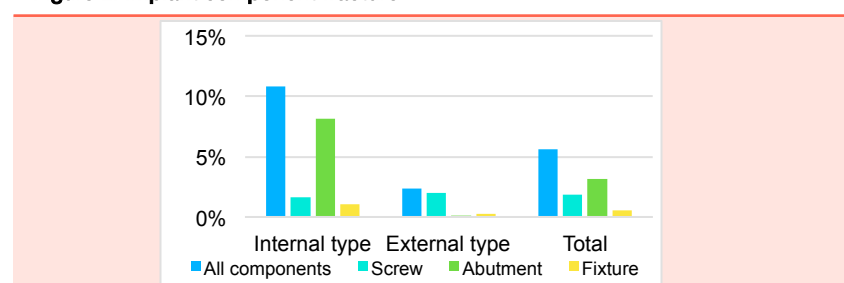
SPSS statistics software (version 24.0, IBM) was used for the statistical analysis. The Pearson chi-square test and Fisher's exact test ( $p=.05$ ) were used to evaluate the association between implant characteristics and implant components fracture.

Figure 1. Implant distribution according to the location and the platform sizes



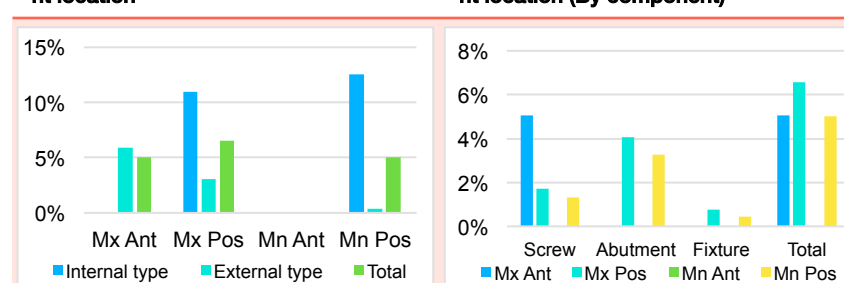
\*Mx=Maxillary, Ant=Anterior, Mn=Mandibular, Pos=Posterior, NP=narrow platform, R P=regular platform, WP=wide platform

Figure 2. Implant component fracture



%=fractured component / total implants X 100

Figure 3. Fractures depending on implant location



NP=Narrow Platform, RP=Regular Platform, WP=Wide Platform

Figure 4. Fractures depending on implant location (By component)

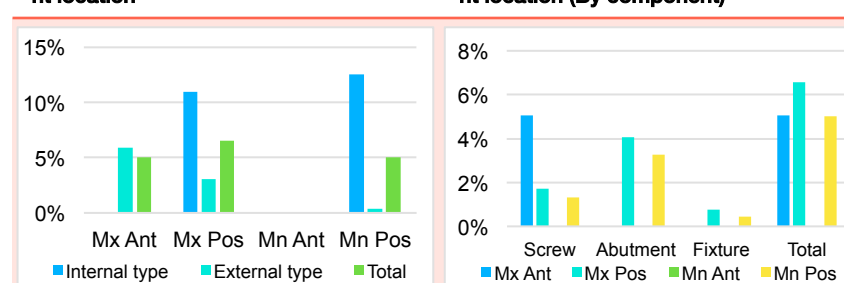
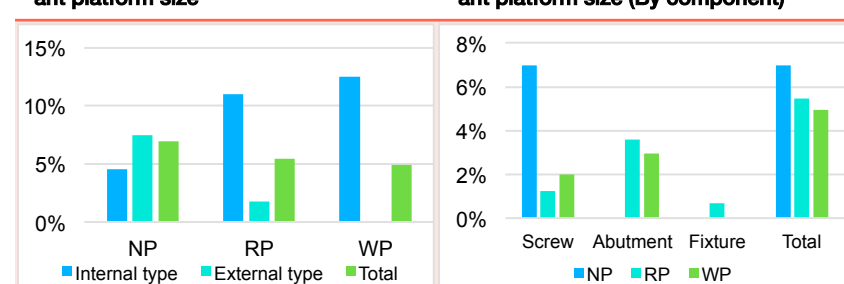


Figure 5. Fractures depending on implant platform size



NP=Narrow Platform, RP=Regular Platform, WP=Wide Platform

Figure 6. Fractures depending on implant platform size (By component)

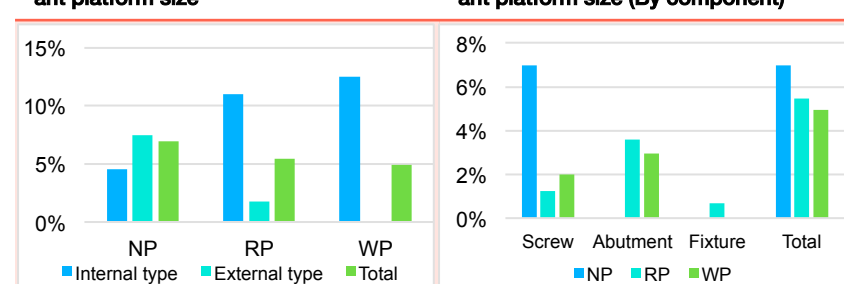


Table 1. How to cope with fractures

		Fractured component		
		Screw	Abutment	Fixture
Internal type	Fixture removal	1(12.5%)	10(25%)	5(100%)
	Prosthesis refabrication(retrieve)	3(37.5%)	29(72.5%)	0(0.0%)
	Screw replacement(retrieve)	4(50.0%)	0(0.0%)	0(0.0%)
	Maintain fracture status	0(0.0%)	1*(2.5%)	0(0.0%)
External type	Fixture removal	0(0.0%)	0(0.0%)	2(100%)
	Prosthesis refabrication(retrieve)	0(0.0%)	1(100%)	0(0.0%)
	Screw replacement(retrieve)	15(93.8%)	0(0.0%)	0(0.0%)
	maintain fractured status	1**(6.2%)	0(0.0%)	0(0.0%)

\* Fractured abutment could not be removed, being used.  
\*\* Fractured screw could not be removed, using new screw cut.

A total of 1,289 implants were placed in 406 patients during investigation period. 799 implants had external type abutment connection (62.0%) and 490 implants were internal type abutment connection (38.0%). 139 implants were placed in the maxillary anterior region (10.8%), 641 implants in the maxillary posterior region (49.7%), 50 implants in the mandibular anterior region (3.2%), and 449 implants in the mandibular posterior region (35.6%). According to the platform size, 129 implants (10.0%) with narrow platform (NP), 1059 implants (82.2%) with regular platform(RP), and 101 implants (7.8%) with wide platform (WP) were placed. (Figure 1)

Of the total 1,289 implants, component fractures occurred in 72 implants (5.6%). In internal type implants, 53 components fractures occurred (10.8%): 8 screw fractures (1.6%), 40 abutment fractures (8.2%), and 5 fixture fracture (1.0%), and in external type implants, 19 components fractures occurred (2.4%): 16 screw fractures (2.0%), 1 abutment fracture (0.1%), and 2 fixture fractures (0.3%). Overall fracture was significantly more frequent in internal type. ( $p<.001$ ) The most frequent fracture component was abutment in internal type implants (8.2%), and screw fracture occurred most frequently (2.0%) in external type. (Figure 2)

### Fractures depending on implant location

The implants were most placed in the maxillary posterior region (49.7%), followed by the mandibular posterior region (35.6%). (Table 1) Table 3 shows the most frequent location which implant component fractures occurred was the maxillary posterior region in internal type (10.9%), and maxillary anterior region in external type (5.9%). Analyzing by fractured components, screw fracture was the most frequent in the maxillary anterior region and the most abutment fracture occurred in the maxillary posterior region significantly. ( $p<.05$ )

### Fractures depending on the implant platform size

There was significant relationship between platform size and fractures. In external type, the number of fractures of NP was larger than that in other platform sizes, and more fractures occurred in the RP than other platform sizes in internal type. (Figure5). Analyzing by fractured components, screw fractures occurred more frequently in NPs and abutment fractures occurred more frequently in RP. (Figure 6)

### How to cope with fractures

When fixture fractures occur, it is considered as an implant failure since no longer function as an implant restoration and must be removed. However, in the case of screw or abutment fractures, the problem can be solved more easily if the fractured fragment can be removed. In other words, obtaining retrievability is the most important point to solve the problem. How to cope with fractures during this retrospective study was as Table 1. Only 12.5% of the fractured screws were not removed in internal type, and 6.2% in external type, in the case of abutment fracture, the abutment fragment removal was impossible in 25% and fixture were removed.

## Conclusion

Comparing the overall implant component fracture of the internal and external types, the fracture rate in internal type was significantly higher than in external type. By implant components, there were no significant difference between internal and external types in screw or fixture fractures, only in abutment fracture, internal type was significantly higher than external type. Depending on the implant location, in internal types, there was no significant relationship between the implant location and each component fracture rates, however, in external types, there was a significant difference in total fracture rate and screw fracture in maxillary anterior region was significantly higher. Analyzing according to implant platform size, NP showed significantly higher total fracture rate and higher screw fracture rates in external type and there was no significant difference in internal type. The screw fracture seems to be easier to solve than the abutment fracture. Therefore, placement of an external type implant rather than an internal type is recommended for the posterior region where abutment fractures frequently occur.

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