

The Prognosis of Endodontically Treated Teeth as an Opposing the Implants

Seung-Mo Eun, Yong-Gun Kim, Jo-Young Suh and Jae-Mok Lee*

Department of Periodontology, School of Dentistry, Kyungpook National University, Daegu, South Korea

*Corresponding Author: Jae-Mok Lee, Department of Periodontology, School of Dentistry, Kyungpook National University, Daegu, South Korea.

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Abstract

Introduction: As implant placement becomes a common treatment process, problems related to implants appear. Because implants are Osseo integrated, they have different effects from natural teeth when functioning as an antagonistic tooth. Among them, research on the prognosis when the endodontically treated tooth functions as the antagonistic tooth of the implant is insufficient. There are studies that endodontically treated teeth become weaker, and other studies that implants do not have PDL, so that have a negative effect on the opposing teeth.

Aim: This study was conducted to examine the prognosis of endodontically treated teeth which is antagonistic tooth of implant

Methods: 91 patients (174 implant) were analyzed, and panoramic view and their chart records were used to investigate whether or not root canal treatment was performed and the teeth were extracted after root canal treatment and post.

Results: The extraction rate increased to 9.3%, 31.4%, 46.7% as additional treatment with natural teeth, endodontic treatment, post added endodontic treatment proceeded. As the additional procedure progressed, the tooth extraction rate showed a tendency to increase.

Conclusions: For endodontically treated teeth, the extraction rate of the antagonistic tooth increases at the time of implantation, and when the post is performed, the extraction rate tends to increase.

Keywords: Dental Implants; Endodontically Treated Teeth; Post Treated Teeth; Prognosis

Introduction

In 1965, Dr. P. Brånemark first placed an implant in a patient, and since the implant was introduced in earnest, the use of implants to replace lost teeth accounts for a large proportion of dental care [1,2]. With interest in people and the improvement of living standards, the number of restorative treatments to preserve teeth and implants to restore edentulous areas has increased [3]. As the replacement of tooth loss by implant placement increases, diseases caused by implants are emerging as a new problem [4].

Implants have become a universal approach in dental care and have become an essential field as an object to be aware of, just like natural teeth. Implants are implanted and have a different structure from natural teeth [5], but it has been found through various cases and studies that they are very similar to natural teeth in terms of the progression and management of surrounding tissue diseases [2].

The implant can function as an adjacent tooth of a natural tooth and as an antagonistic tooth. Although there are numerous studies on implants, there are very few studies with regard to the prognosis of endodontically-treated teeth as antagonists of implants.

It is widely accepted that teeth undergoing root canal treatment are more susceptible to fracture than vital teeth due to the pathological and biomechanical changes that have occurred before [7]. And it is known that the root canal post does not strengthen the teeth, as it weakens the teeth by removing significant tooth structure in the process of preparing the post space [8].

Bone is constantly remodeling itself in response to occlusal stimuli and other factors [9,10]. Implants without periodontal ligaments have a different response to occlusal force than natural teeth [5], Urdaneta, *et al.* (2011) [11] reported an increase in the amount of bone loss of natural teeth when there is a natural tooth as an implant restoration opposing tooth. Also, Urdaneta, *et al.* (2014) [12] compared the amount of bone loss between the implant and the natural tooth, and reported that the amount of bone loss was higher when the implant was the antagonist. This means that the prognosis of natural teeth using implants as an opposing tooth is worse than that of natural teeth as an opposing tooth.

However, these studies are related to comparison with vital teeth, not non-vital teeth. In addition, studies have been conducted to observe the prognosis of root canal treatment or post-added endodontic treated teeth, natural teeth, and implants in patients with chronic periodontitis [13], but studies on the prognosis of endodontically treated teeth as adjacent or antagonist teeth are rare [14]. Prior to this study, Kim, *et al.* (2021) [15] studied the effects of adjacent and antagonist teeth on the prognosis and the cause of tooth extraction prior to implant restoration by focusing on implant-related factors. In the previous study, a study was conducted on the prognosis in terms of overall treatment such as crown, resin restoration, amalgam filling, GI filling, etc. Although a study on the prognosis in terms of overall treatment was performed, detailed studies on endodontically treated and post- added endodontic treated teeth are considered insufficient.

The purpose of this study is to investigate whether the prognosis of this opposing tooth is affected by the endodontic treatment. In terms of the effect of implant treatment on endodontically treated opposing teeth, few studies on the prognosis of natural teeth have been conducted and are insufficient. In addition, the prognosis of the tooth with the post applied as the implant opposing tooth will be examined.

Materials and Methods

This study was conducted on 91 patients who visited Kyungpook National University Dental Hospital between 2005 and 2019 and had implants placed and prosthetic restorations under the diagnosis of chronic periodontitis. A total of 165 implant sites were investigated. Cases with at least one antagonist at the implant site were included, and endodontic treatment of the antagonist, the presence or absence of a post, and post-implant extraction were investigated. Cases with severe bone loss of the antagonist prior to implant placement were excluded. In this study, panoramic radiographs were investigated as a basis, and radiographs and chart records taken during observation after implant placement were used to investigate whether or not root canal treatment was performed and the teeth were extracted after root canal treatment and post.

Data on the presence or absence of endodontic treatment and post for the implant opposing tooth were established. In addition, the cause of extraction of the antagonist was investigated and classified into periodontal reasons, fracture, and caries.

Chi-square test and Fisher's exact test were performed to determine the relationship between the prognosis of the implant and the antagonist. All analyzes were performed using the SPSS program.

Results

A total of 174 implant abutments were analyzed in 91 patients. Teeth that were scheduled to be extracted due to severe periodontitis before implant placement were excluded. According to a study by Kim., *et al.* (2021) [15], the extraction rate of adjacent and antagonist teeth due to periodontal causes was 65%, and the extraction rate, which was 14% due to caries, was not included.

First, a null hypothesis was established that there was no correlation between the two variables of the natural tooth and the endodontic treatment or the endodontic treatment and the post-added endodontic treated teeth, and as an alternative hypothesis, the relationship between the two variables was assumed. Table 1 and 2 were obtained through the chi-square test for the presence or absence of extraction between natural teeth and endodontic treatment or endodontic treatment and post-treatment (Table 1 and Table 2).

		Treatment			
			natural teeth	endo. + endo. and post	all
Tooth extraction	non-extraction	frequency	98	43	141
		expected frequency	87.5	53.5	141.0
		% of tooth extraction	69.5%	30.5%	100.0%
		% with or without treatment	90.7%	65.2%	81.0%
	tooth extraction	frequency	10	23	33
		expected frequency	20.5	12.5	33.0
		% of tooth extraction	30.3%	69.7%	100.0%
		% with or without treatment	9.3%	34.8%	19.0%
all	frequency	108	66	174.0	
% of the presence or absence		expected frequency	108.0	66.0	174.0
% with or without treatment		62.1%	37.9%	100.0%	
		100.0%	100.0%	100.0%	

Table 1: Cross table with or without extraction and with or without treatment.

	value	degrees of freedom	Approximate Significance Probability (Two-tailed test)	Probability of Precise Significance (Two-tailed test)	Exact significance (one-sided test)
Pearson chi-square	17.454	1	.000	.000	.000
Continuity correction	15.829	1	.000		
Likelihood ratio	17.058	1	.000	.000	.000
Fisher’s exact test				.000	.000
Linear to linear combination	17.354	1	.000	.000	.000
number of valid cases	174				

Table 2: Chi-square test with and without treatment.

According to statistics, $\chi^2 = 17.454$ and p value = 0.000, so we can reject the null hypothesis and adopt the alternative hypothesis that there is a relationship between the two variables. That is, endo. or endo. and post, it was found that there was a correlation with tooth extraction.

A chi-square test was performed to examine the correlation between the tooth that had undergone only endodontic treatment and the tooth that had undergone post added endodontic treatment in the same way to examine whether the post trial was related to the tooth extraction rate. A null hypothesis was established that there was no correlation between the two variables, and it was assumed that there was a correlation between the two variables as an alternative hypothesis. As a result of the chi-square test, Tables 3 and 4 were obtained (Table 3 and Table 4).

		Post presence				
			endo.	endo. and post	all	
tooth extraction	non-extraction	frequency	35	8	43	
		expected frequency	33.2	9.8	43.0	
		% of tooth extraction	81.4%	18.6%	100.0%	
		% with or without treatment	68.6%	53.3%	65.2%	
	tooth extraction	frequency	16	7	23	
		expected frequency	17.8	5.2	23.0	
		% of tooth extraction	69.6%	30.4%	100.0%	
		% with or without treatment	31.4%	46.7%	34.8%	
		all	frequency	51	15	66
		% of tooth extraction	expected frequency	51.0	15.0	66.0
% with or without treatment		77.3%	22.7%	100.0%		
		100.0%	100.0%	100.0%		

Table 3: Cross table of the presence or absence of tooth extraction according to the progress of the post.

	value	degrees of freedom	Approximate Significance Probability (Two-tailed test)	Probability of Precise Significance (Two-tailed test)	Exact significance (one-sided test)
Pearson chi-square	1.194	One	.274	.358	.215
Continuity correction	.616	One	.433		
Likelihood ratio	1.162	One	.281	.358	.215
Fisher's exact test				.358	.215
Linear to linear combination	1.176	One	.278	.358	.215
number of valid cases	66				

Table 4: Chi-square test with and without post.

According to statistics, $\chi^2 = 1.194$ and p value = 0.274, so we can accept the null hypothesis and reject the alternative hypothesis that there is no correlation between the two variables. In other words, it was possible to obtain the result that there was no correlation between the presence or absence of a post and tooth extraction.

A linear versus linear combined analysis was performed to determine the trend of increase or decrease in the tooth extraction ratio during additional treatment of endodontic treatment, post added endodontic treatment. The null hypothesis is that the extraction rate is constant regardless of the additional treatment of the implant opposing tooth, and the alternative hypothesis is that the extraction rate tends to increase/decrease as additional treatment proceeds. As a result of the linear versus linear binding assay, the results shown in tables 5 and 6 were obtained (Table 5 and Table 6).

			Natural Teeth	Endo.	Endo. & Post	All
Tooth Extraction	Tooth Extraction	Frequency	10	16	7	33
		expected frequency	20.5	9.7	2.8	33.0
		% of tooth extraction	30.3%	48.5%	21.2%	100.0%
		% in treatment	9.3%	31.4%	46.7%	19.0%
	non-extraction	frequency	98	35	8	141
		expected frequency	87.5	41.3	12.2	141.0
		% of tooth extraction	69.5%	24.8%	5.7%	100.0%
		% in treatment	90.7%	68.6%	53.3%	81.0%
all		frequency	108	51	15	174
% of tooth extraction		expected frequency	108.0	51.0	15.0	174.0
% in treatment		62.1%	29.3%	8.6%	100.0%	
		100.0%	100.0%	100.0%	100.0%	

Table 5: Cross-table with or without tooth extraction according to additional treatment.

	Value	Degrees Of Freedom	Approximate Significance Probability (Two-Tailed Test)	Exact Significance (Two-Tailed Test)	Exact Significance (One-Sided Test)
Pearson chi-square	19.218	2	.000	.000	
Likelihood ratio	18.220	2	.000	.000	
Fisher’s exact test	18.492			.000	
Linear to linear combination	18.913	One	.000	.000	.000
number of valid cases	174				

Table 6: Chi-square test on the presence or absence of tooth extraction for additional treatment.

According to statistics, the extraction rate increased to 9.3%, 31.4%, and 46.7% as additional treatment with natural teeth, endodontic treatment, post added endodontic treatment proceeded. It can be concluded that the ratio of tooth extraction rate tends to increase as the alternative hypothesis of additional treatment proceeds while rejecting the null hypothesis that it is constant. (p < 0.05).

Discussion

In the results of this study, it was confirmed that the tooth extraction rate was increased when the implant antagonist received endodontic treatment. Tronstad, L [7] reported that tooth resilience was lowered by caries restoration, access cavity preparation, root canal flaring of the cervical area, and moisture loss of dentin. In addition, Urdaneta, *et al.* [11] reported that the amount of bone loss was higher when the implant was an opposing tooth compared to a natural tooth. Through this study, it was confirmed through this study that the tooth extraction rate was high in the presence of implants as an antagonist with endodontic treatment, and the prognosis was poor compared to natural teeth that were not treated with endodontic treatment. This was consistent with the results of previous studies. It is thought that this is probably due to the combination of the increased possibility of tooth fracture due to the occurrence of tooth material loss due to tooth preparation during endodontic treatment and the excessive occlusal force of the implant without periodontal ligament. In addition, Tronstad, L [7] said that the preparation for the post weakened the teeth without strengthening the teeth due to significant loss of tooth material. However, in the results of this study, it was confirmed that post application did not significantly increase the extraction rate when the implant was an antagonist. Through this, it was possible to infer that additional tooth material preparation for post did not affect the significant results shown in tooth material preparation for endodontic treatment.

However, when looking at the tendency of tooth extraction for endodontically treated teeth and teeth that had progressed to the post, it was confirmed that the tendency for a poor prognosis increased as the number of tooth material preparations for conservative treatment increased.

The dentition, occlusal pattern, occlusal force, and prosthetic restoration status of each patient are various and influencing factors, but it is considered to be a limitation that it is not limited. Another limitation is that implants and endodontic treatments were performed by various surgeons, making it difficult to control the experimental group. Further studies are needed to overcome these limitations.

Conclusions

The tooth that has been treated with endodontic treatment is the antagonist of the implant exhibit higher possibility of extraction than the tooth has not been treated with endodontic treatment. Compared with teeth that have undergone only endodontic treatment, tooth extraction rate does not increase significantly when endodontic treatment and post are performed.

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