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An Investigation of the Factors Affecting the Results of Periapical Surgery

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ABSTRACT

Background and Objective: Periapical surgery is a reliable method for treating teeth with periapical lesions for which conventional root canal treatment methods are not effective. The aim of this study is to investigate the results of periapical surgical treatment after a follow-up period of one to five years and the factors related to the success rate of the treatment.

Methods: In this cross-sectional study, complete clinical and radiographic examinations were performed on 128 patients who underwent periapical surgery in the endodontics department of Mashhad Dental School. The success of the treatment was evaluated based on radiographic and clinical criteria for three groups: recovered, recovering and non-recovering. The patients were examined in terms of the relationship between the success rate of periapical surgery and the variables of age, gender, type of tooth, type of jaw, presence of post, type of coronal restoration and the presence of preoperative symptoms.

Findings: From a total of 128 patients, 64 patients including 35 women and 29 men were studied. The results showed that the number of successful treatments is higher in women and in anterior teeth, although their difference was not statistically significant. In the age range of 11 to 30 years, all treatments were successful, with a treatment success rate of 89% in the recovered and recovering groups. In addition, there was no statistically significant difference in the success rate of periapical surgery in terms of factors such as the type of jaw, the presence or absence of a post, the presence of symptoms before treatment, and the type of tooth restoration.

Conclusion: The results of this study showed that periapical surgery can be considered as an effective treatment method for patients. In addition, factors such as age, gender, type of jaw, presence or absence of post, presence of symptoms before treatment and type of tooth restoration do not have a significant effect on the treatment result.

Keywords: *Periapical Surgery, Success Rate, Cross-Sectional Study.*

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Introduction

Periapical surgery is usually prescribed for the treatment of apical periodontitis when conventional treatments (root canal treatment or retreatment) fail and in cases where periradicular tissues require direct observation, debridement, or biopsy (1). Studies show that the failure rate of primary root canal treatment is 14-16% and the prevalence of apical periodontitis in teeth that have undergone root canal treatment is 39% (2, 3). Therefore, periapical surgery is not considered as the first choice in the treatment of periapical diseases and is usually used after root canal treatment or retreatment. Moreover, in anatomic problems (such as severe calcification or severe root curvature), non-removable broken file, endodontist errors (such as overfilling or ledge), large lesions, restorative considerations (e.g. when post removal or access through the crown is considered very dangerous), periapical surgery is considered a suitable alternative (4).

In addition, these studies showed that retrograde surgical treatment is more successful in the short term compared to orthograde retreatment, but the clinical success of orthograde retreatment is greater than surgical intervention in the long term (5). Studies have shown that the clinical success rate of surgical treatment is about 80% and the introduction of modern techniques can improve the clinical success rate (6). Setzer et al. stated that microsurgery is 1.58 times more successful than traditional surgery in 5-month follow-up and their long-term success is comparable to non-surgical retreatment (7).

The success rate of apical surgery can depend on various factors such as the gender of the patient, the position of the tooth in the dental arch, the type of root filling material, as well as the use of microsurgery tools, ultrasonic tools, and magnification. The factors related to the success rate of periapical surgery are divided into three groups: patient-related, tooth-related and treatment-related (8, 9). In tooth-related factors, cases without pain and symptoms before surgery, cases without periapical lesions and teeth with lesions less than 5 mm showed better treatment results. In treatment-related factors, more improvement was achieved by using the endoscope, but the effect of patient-related factors (age and gender) on the success rate of the treatment was not significant. The aim of this study is to investigate the effect of different factors on the success rate of periapical surgeries performed in the endodontics department of Mashhad Dental School.

Methods

After being approved by the ethics committee of Mashhad University of Medical Sciences with code IR.MUMS.DENTISTRY.REC.1398.038, this cross-sectional study was conducted among the patients who underwent periapical surgery in the endodontics department of Mashhad University of Medical Sciences. Patients with systemic disease (e.g. diabetes), patients without informed consent, patients with unclear preoperative symptoms, and patients with inappropriate radiographic images were excluded from the study. Therefore, patients with an age range of 11 to 67 years and with informed consent were evaluated. All periapical surgeries were performed by final-year specialist assistants under the supervision of a professor. The patients were evaluated in terms of the success rate of periapical surgery and its relationship with the variables of age, gender, type of teeth, type of jaw, presence of post, type of coronal restoration and the presence of preoperative symptoms.

In preparing the radiograph, we tried to make the angle of the radiation tube as similar as possible to the post-surgery radiograph. Clinical examinations of the relevant teeth including percussion test and probing depth were performed. Then, radiographic images after surgery and follow-up were evaluated by two endodontists independently and with double magnification. In teeth where surgical treatment was performed for more than one root, the result was considered based on the root with the worse condition. In cases where the two observers did not agree, a third person (another endodontist) was consulted. According to the

radiographic findings, the results of each treatment were classified as success, failure or doubtful cases as follows:

- **Radiographic success:** lack of radiographic lesion. This means that the existing lesion at the time of surgery has healed or no new lesion has formed.
- **Suspicious cases:** asymptomatic and functional cases. This means that the lesions have become smaller, but not gone.
- **Radiographic failure:** continuation or formation of a radiographic lesion. This means that the radiolucent lesion has become larger or has formed after treatment.

According to a study by Friedman et al., the success rate of the treatment was divided into recovered, recovering and non-recovery based on clinical and radiographic evaluations (10). Teeth without clinical signs or symptoms and success in radiography were considered as recovered, teeth without clinical signs and symptoms and suspicious radiography as recovering, and teeth with clinical signs and symptoms or failure of radiography as non-recovery.

Mean and standard deviation indices were used to describe quantitative variables, and frequency and percentage were used for qualitative variables. To analyze the main findings, first the normality of the variables was evaluated using the Kolmogorov Smirnov test, then Mann-Whitney and Wilcoxon tests were used for non-normal variables, and paired T-test and independent T-test were used for normal variables. SPSS version 21 was used and $p<0.05$ was considered significant.

Results

In this study, 35 women and 29 men with an age range of 11 to 67 years were evaluated in terms of the success rate of periapical surgeries. First, the normal distribution of the data was investigated and then the age variable was distributed normally in all groups. In this study, 51 patients were in the recovered group, 6 patients were in the recovering group, and 7 patients were in the non-recovering group. According to the Kruskal-Wallis test, the highest and lowest mean ages in the recovering and recovered groups were observed as 40.33±8.69 and 39.27±12.06 years, respectively, and the mean age between the groups was not significantly different. In addition, the highest and lowest follow-up means were observed for the non-recovering and recovering groups with the means of 18.71±14.91 and 5.17±1.33, respectively, but there was no statistically significant difference between these groups.

In examining the success rate by age grouping (ages 11-30, 31-50, and 51-70), all the improved cases were observed in the age group of less than 30 years, but the distribution of the type of success in different age groups showed no statistically significant. Moreover, despite a 13.3% increase in the success rate of treatment in women compared to men, the investigation of the effect of gender on the type of success based on Fisher's exact test showed that the distribution of the type of success in women and men is not statistically significant.

The distribution of the type of success in anterior and posterior teeth was not statistically significant, but there were more cases of recovered and recovering cases with 4.3% and 2.4% in anterior teeth than in posterior teeth, respectively. In regard with the association between treatment success rate and the type of jaw, the highest success rate was observed for the upper jaw and the recovering group, but the distribution of the type of surgical success in the two jaws was not statistically significant. In addition, in the presence and absence of the post, the highest frequency was observed in the improved group, and its statistical distribution was not significant. The effect of crown restorations (amalgam, composite, veneer and bridge) on the success rate of periapical surgery showed that the highest success rate is related to the improved group, although the distribution of the type of success in the types of crown restorations was not statistically

significant. Regarding the effect of pre-treatment symptoms on the success rate, the highest frequency was related to the success of the improved group and the lowest frequency was equally related to the other two groups. Since the number of treated cases without preoperative symptoms was very small (2 cases), statistical analysis was not performed. Regarding the relationship between the type of success rate and the cause of the need for surgery, in the cases of poor filling of the canal, which is the most common reason for the need for surgery (55 cases), the highest frequency was related to the improved group. Other reasons for the need for surgery include four cases of tooth erosion, one case of perforation, and two cases of undetected canals, which were not statistically analyzed due to the small number. In apical and curettage surgeries, which constitute the most type of surgery (56 cases), the highest frequency was related to the success of the improved group. Other types of surgery include two cases of autotransplantation, one case of perforation repair, four cases of rehabilitation of erosion and one case of intentional replantation. Due to the small number of other types of surgery, statistical analysis was not performed.

Discussion

In this study, the investigations showed that the number of successful treatments is higher in women and in anterior teeth, although their difference was not statistically significant. Also, in the age range of 11-30 years, all the treatments were successful and the treatment success rate in the recovered and recovering groups was 89%. In various studies, age has been considered as an important factor in many surgical procedures (11). In the present study, the highest rate of recovery was achieved in patients under 30 years old. These results are in line with the studies of Kreisler et al. (12). In addition, in the study of the effect of age on the success of treatment by Öğütlü et al., most cases of complete recovery were observed in patients aged 11-30 years (6). Moreover, Kim et al. showed that every year the patient's age increases, it can lead to a 6% increase in the probability of periapical surgical treatment failure (13). Therefore, these findings are in line with the results of the investigations carried out in this study. In the study of Liao et al., the success of periapical surgical treatment was observed in women under 60 years of age, and the factors of tooth type, post, and lesion area did not have a specific effect on treatment improvement (9).

In the study of Sutter et al., the success of periapical surgical treatment was significantly related to the type of tooth, but it was not significantly related to upper and lower teeth and signs of inflammation at the time of initial examination (14). This study showed that the success of treatment in anterior teeth is higher compared to premolar or molar teeth. Furthermore, in the studies of Yoo et al. and Lai et al., the success of periapical surgery was observed in anterior teeth more than posterior ones (15, 16). In the present study, due to the better accessibility of anterior teeth and the complex anatomy of posterior teeth, better results of periapical surgery were obtained in anterior teeth.

Evaluations of Öğütlü et al. showed that pain or inflammatory symptoms before surgery can lead to poorer treatment results (6). In addition, Von Arx et al. stated that the presence of symptoms before treatment can prevent surgical recovery (8). The results of Kreisler et al. also showed that there is a lower success rate in patients with pain before periapical surgery (12). However, Sutter et al. and Ahmed et al. did not observe a difference in the relationship between surgical success rate and symptoms before treatment (14, 17). In the present study, since the number of treated cases without symptoms before operation was very small, comparison and statistical analysis was not possible. Moreover, similar to the results of this study, there was no significant relationship between the success rate of periapical surgery and gender in various studies (1, 18). One- to five-year follow-ups of teeth treated with periapical surgery show an acceptable rate of recovered cases. The results showed that few factors are effective in the success rate of treatment.

The results of this study showed that periapical surgery can be considered as an effective treatment method for patients. In addition, factors such as age, gender, type of jaw, presence or absence of post, presence of symptoms before treatment and type of tooth restoration do not have a significant effect on the treatment result.

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