

Success Rate of Intentional Replantation of Endodontically Treated Teeth “A Systematic Review”

Sirrage Kazi M Yaqoob^{1,*}, Sana Siddiqui², Saeed Kazi M Yaqoob³

¹BDS, MASTER Advanced Oral Sugary and Dental Implantologi, UNIVERSITÀ DEGLI STUDI “ALDO MORO” Bari, Italy

²BDS, MDS Operative Dentistry, Shaheed Zulfikar Ali Bhutto Medical University, PIMS, Islamabad, Pakistan

³BDS, MCS Endodontics, MCPS resident Periodontology, Federal Government Services Hospital, Islamabad, Pakistan

ABSTRACT

Introduction: This study aimed to systematically assess the outcomes of intentional replantation (IR) of teeth and to determine success rate of the treatment. A search was conducted for all relevant English language articles published in the previous ten years **Methods:** The search terms included “intentional replantation” and “teeth” according to the inclusion criteria. Two reviewers independently screened the literature based on the inclusion criteria.

First, the reviewers read the relevant abstracts from the literature.

Second, to evaluate literature quality, the full texts were obtained, including the inclusion criteria, relevant information on the first author, publication year, type of study, number of cases, age and outcomes.

Then, manual search was performed using the reference lists of the included studies to identify additional articles.

Strict and uniform inclusion and exclusion standards were applied to select the literature, and two independent researchers used a blind method to reduce the selection bias. To thoroughly assess each included study and lower the within-study bias, the methodological index for non-randomized studies (MINORS) score standard [14] was applied for quality assessment.

Each item in the MINORS has three scores:

0, unreported;

1, reported but inadequately or partially;

2, adequately reported.

All extracted data were double-checked, and any questions that arose during the screening and data extraction were discussed within the group to achieve a consensus.

If consensus was not attained, a third reviewer served as an adjudicator.

Results: The Methodological Index for Non-randomized Studies

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*Corresponding Author

Sirrage Kazi M Yaqoob, BDS

MASTER Advanced Oral Sugary and Dental Implantologi, UNIVERSITÀ DEGLI STUDI “ALDO MORO” Bari, Italy, Phone: 00966549519798; E-mails: s.q.m.y@live.com; drsirajsindi@gmail.com

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(MINORS) was used to assess the methodological quality of included studies. Nine studies were identified as relevant for the systematic review. In total, 806 patients with 806 teeth were examined for intentional teeth replantation. The success rate was greater than 90% in five studies (55.55%) and between 70% and 80% in four studies.

The success rate for post-surgical outcomes of intentional replantation of teeth cases is 87.95%

Conclusion: The long-term success and survival rate of IR are likely dependent upon short extra oral time, reduced pocket depth, type of tooth, type of root-end filling material, and the prevention of atraumatic tooth root damage.

Keywords: Intentional Replantation, Tooth, Survival Rate, Root Canal Treatment, Systematic Review.

INTRODUCTION

The essential objectives of endodontic treatment are the anticipation and/or determination of pulpal and periapical pathoses with the re-establishment of healthy periradicular tissues. Nonsurgical root canal treatment (NSRCT) gives tall long-term survival and success rates [1-4], However, healing does not continuously take after NSRCT; apical periodontitis can persist [5-7]. Moreover, effectively treated teeth can ended up reinfected through coronal micro leakage after a period of health [8].

Such persistent or modern pathoses can be treated by nonsurgical retreatment with success rates of 77%–78% [9,10]. When a tooth has been non surgically retreated and infection continues, alternatives include no treatment; extraction and replacement using a single- tooth implant, a fixed dental prosthesis, or apical microsurgery; a removable dental prosthesis; and auto transplantation and intentional replantation.

Apical microsurgery may be recommended if a patient prefers to keep his or her native tooth. Healing times have been reported to range from 10 to 12 hours. According to one systematic review, early healing rates were 78 percent at 2 to 4 years, but by 4 to 6 years, they had declined to 72 percent [10].

Another detailed analysis revealed a 94 percent success rate. Another systematic review found that modern apical microsurgery had a 94 percent success rate, while traditional apical surgery has a 59 percent success rate [11].

Modern apical microsurgery's excellent success rate has been linked to advancements in procedures, instruments, and materials [12]. This study combined data from experiments

with various follow-up durations, ranging from 6 to 276 months [12].

A new systematic review evaluating the outcomes of endodontic microsurgery versus tooth replacement with an implant-supported single crown (ISC) found that teeth treated with modern apical surgery had a 92 percent survival rate [13].

Teeth treated with modern apical surgical procedures have been proven to heal satisfactorily after 5 years [14].

Anatomic factors such as the mental foramen, mandibular canal, or thick bone, periodontal attachment loss, or certain medical conditions may make apical surgery contraindicated. For some of these situations, intentional replantation is the best option.

Inclusion criteria

Following studies were included:

1. Studies done in last 10 years on the topic of intentional replantation after root canal treatment.
2. English language.
3. A minimum of 5 cases.
4. Mean follow-up of at least 1 year.
5. Reported details of Intentional replantation.
6. Case series, randomized controlled trial (RCT), prospective and retrospective study type.

Exclusion criteria

Following studies were excluded:

Studies not meeting all the inclusion criteria were excluded from the review.

Publications dealing with the following topics were also excluded:

- a. Animal studies
- b. Intentional replantation after traumatic injury
- c. Compromised periodontal health/prognosis.

RESULTS

The research has conducted meta-analysis method using MedCalc software. Meta-Analysis technique is statistical technique used for analyzing results of literature reviews. Meta-Analysis consists of several tests & graphs. Forrest plot is used for determining which effect size type (fixed, random) is suitable for analysis. the homogeneity of the studies is an important feature to make sure that the random effect is the

suitable for studying the effect of each study, we can test the homogeneity using Quochran test. Funnel plot is used for checking Publication Bias.

The researcher has searched 320 studies related to the topic, 200 studies were excluded because they were irrelevant

studies. 105 studies were excluded because they were before 2011 or had less than 5 cases or there are no follow ups, 6 studies were excluded because of non-availability full text. Finally, the researcher has used 9 studies as shown in figure (1).

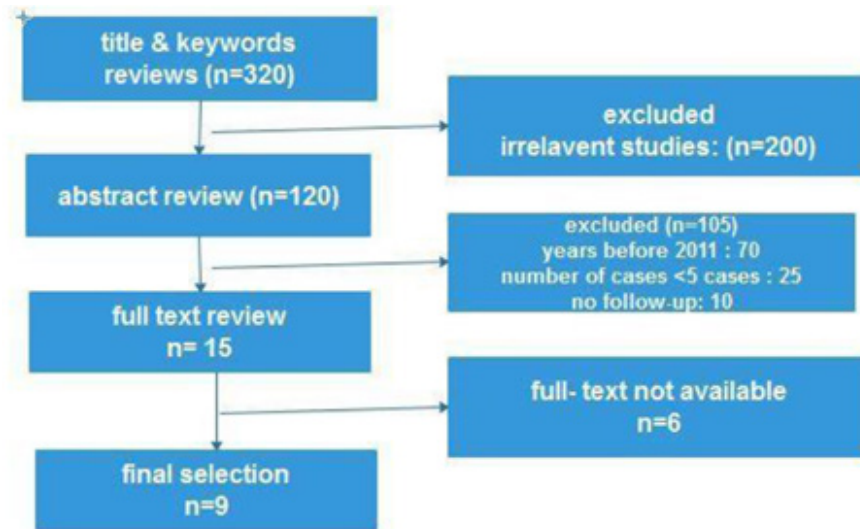


Figure 1. Shows PRISMA chart

Source: prepared by the researcher

Raw data

The researcher has used 9 studies related to Intentional

Replantation of Teeth. The researcher relied on calculating success rate for Intentional Replantation of Teeth according to the following table.

Table 1. Shows characteristics of the studies related to Intentional Replantation of Teeth

Study	Number of Cases	Success Cases
Cho et al., 2017	103	83
Nizam et al., 2016	27	21
Cho et al., 2016	196	186
Jang et al., 2016	41	30
Choi et al., 2014	287	273
Lee et al., 2014	27	20
Asgary et al., 2014	20	18
enamel matrix 2011	12	12
Choi & Bae 2011	93	89

Source: prepared by the researcher based on literature reviews

Selecting suitable effect size

In this section the researcher aims to select the appropriate effect size for the used studies according to two techniques will be mentioned as follows

Forrest plot

In this section the researcher will use forrest plot to determine which effect size type (fixed, random) is suitable.

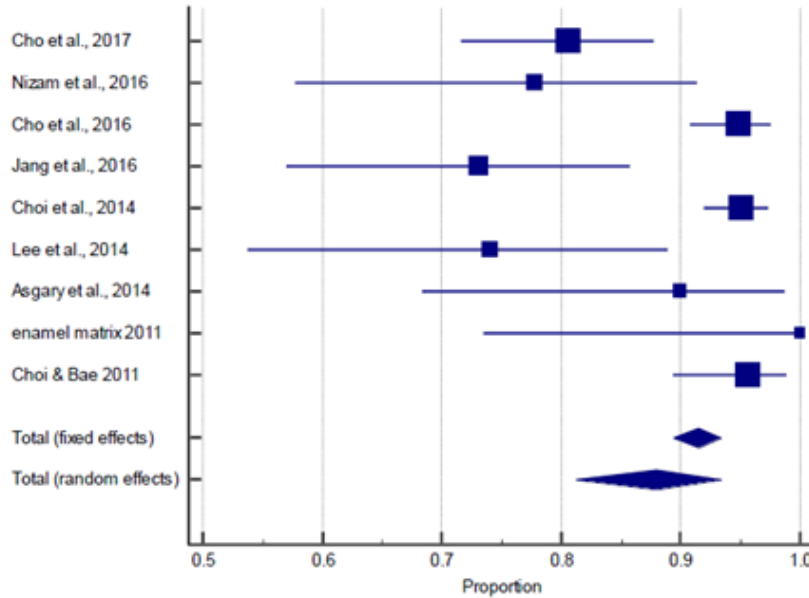


Figure 2. Shows forrest plot

From the previous table we can say that

The diamond for the random effect is wider than the diamond for fixed effect, so the random effect is the suitable for study the effect size of each study.

Testing the homogeneity of the studies

The homogeneity of the studies is an important feature to make sure that the random effect is the suitable for studying the effect of each study, we can test the homogeneity using Quochran test the null hypothesis: there is no homogeneity the alternative hypothesis: there is homogeneity

Table 2. Shows homogeneity test

Q	46.1301
DF	8
Significance level	P < 0.0001
I² (inconsistency)	82.66%
95% CI for I²	68.43 to 90.47

From the previous table we can say that

There is homogeneity in results where the significance level=0.0001 is less than $\alpha=0.05$ so we will reject the null hypothesis, also the value of I2 (inconsistency) =82.66%

which is higher than 50%.

As a result of homogeneity, the appropriate effect size is random effect size.

*Estimating the effect size for each study***Table 3.** Shows effect size of studies

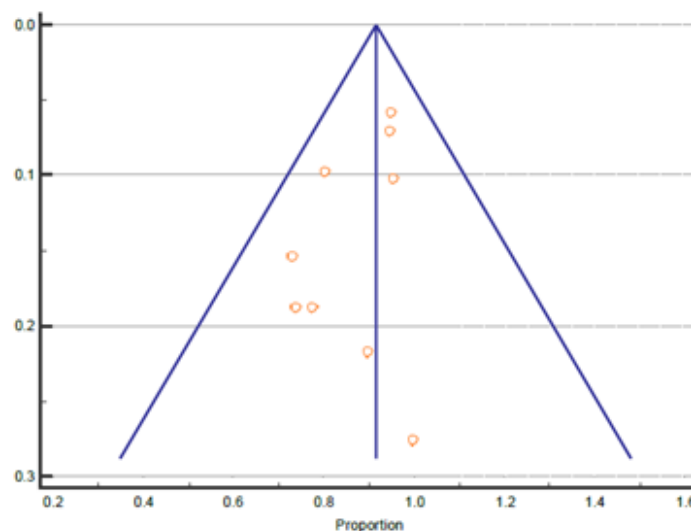
Study	Samplesize	Proportion(%)	95% CI	Weight (%)	
				Fixed	Random
Cho et al., 2017	103	80.583	71.6 to 87.7	12.76	13.17
Nizam et al., 2016	27	77.778	57.7 to 91.3	3.44	9.58
Cho et al., 2016	196	94.898	90.8 to 97.5	24.17	14.09
Jang et al., 2016	41	73.171	57.0 to 85.7	5.15	10.94
Choi et al., 2014	287	95.122	91.9 to 97.3	35.34	14.45
Lee et al., 2014	27	74.074	53.7 to 88.8	3.44	9.58
Asgary et al., 2014	20	90	68.3 to 98.7	2.58	8.52
enamel matrix 2011	12	100	73.5 to 100	1.6	6.69
Choi & Bae 2011	93	95.699	89.3 to 98.8	11.53	12.98
Total (fixed effects)	806	91.494	89.3 to 93.3	100	100
Total (random effects)	806	87.957	81.2 to 93.3	100	100

From the previous table we can say that

- Total number of cases for 9 studies were 806.
- The success rate for post-surgical outcomes of intentional replantation of teeth cases is 87.95%.

Checking publication bias

In this part we will check if the researcher makes any bias in selecting the studies using funnel plot. If the small circles were inside the funnel and have no pattern we can conclude that there is no biasness in selecting the studies.

**Figure 3.** Shows publication bias

From the previous graph we can say that

There is no publication bias where all the small circles were inside the funnel and have no pattern, so we can conclude that there is no biasness in selecting the studies.

OUTCOME

The success rate for post-surgical outcomes of intentional replantation of teeth cases is 87.95%.

DISCUSSION

The survival rate of IR was the subject of this systematic review, which included nine studies. The findings of the meta-analysis revealed that short extraoral duration, decreases in pocket depth, type of tooth, type of root-end material filling, and prevention of atraumatic tooth root damage are all likely to improve IR long-term success and survival rates.

Although a minor percentage of patient data was lost in five studies, the follow-up data in the studies that were included was essentially complete. In big samples, the follow-up rate was 100%, whereas in small samples, it was greater than 70%.

In all investigations, the calculated success rate was greater than 70%, with five studies reaching 90%. In the short-term follow-up, the survival rate was as high as 90%.

The survival rate was dropped from 12 to 36 months after the follow-up period was extended. The survival rate was somewhat lowered and tended to be stable when the follow-up was higher than 36 months.

The long-term survival rate was low, showing that maintaining a high. Survival rate for teeth with difficult periodontal and pulpal diseases are widespread and prevalent in natural teeth [15,16] and they can occur in the same tooth at the same time; they can be combined to generate endodontic-periodontal lesions. Because of the difficulty in diagnosing endodontic periodontal diseases, treatment is challenging. Because non-surgical root canal treatment and periapical surgery are not viable in endodontics, purposeful teeth replantation is considered the last treatment option for apical periodontitis.

Atraumatic tooth extraction, elimination of local factors on both the tooth surface and the extraction socket, and reinsertion of the tooth are all part of the IR procedure.

Many IR failures have been ascribed to a range of factors, including difficulties and extraction procedures, fracture type, pocket depth, and root-end filling materials.

Complications after surgery included refracture, ramifications, root resorption, and abscess formation in various tooth sections such as the periodontal pocket, dental pulp, and root, which are the main factors contributing to IR failures.

Many investigations have identified vertical root fractures (VRFs) as a severe fracture type that can cause substantial periodontal tissue destruction, resulting in discomfort, edema, sinus tract development, increased tooth mobility, deep periodontal pockets, and vertical bone resorption [14,16].

Extraction failures were primarily caused by a difficult periapical approach and an insufficient extraction time. By limiting periodontal cell damage and dehydration, a reduction in extra oral time is critical in the prevention of ankylosis and root resorption, as well as the development of

the periradicular healing process.

Extra oral time has been identified as a significant factor influencing surgery outcomes in previous research. According to Cho et al. [17], an extra oral duration of more than 15 minutes increases the risk of problems and ankylosis. Furthermore, extra oral time is the most important factor in periradicular healing.

According to Pohl et al. [18], if the extra oral period for replanted teeth is more than 15 minutes, root resorption is likely to occur, and the risk of problems is 1.7-fold higher, lowering the IR survival rate.

According to some studies, tooth survival with healthy gingiva is linked to large reductions in pocket depth. The maximum value of six measures surrounding the tooth was used by Jang et al. [19] to determine pocket depth as a typical indicator of periodontal status. Choi et al. [20] used radiography and periodontal probing to confirm normal physiologic mobility and modest periodontal pocket depths (5 mm).

Renvert and Persson [21] conducted a systematic evaluation and found that residual probing depths more than 6 mm were linked to dental disease development.

Incomplete data and a lack of studies on this research issue were the main limitations of this systematic review.

First, the assessment results and quality were harmed by insufficient indicators and missing data. These studies rarely reported bone loss, periotest values (PTV), or gingival index (GI), which substantially lowered the quality of the publications.

In other research, the survival rate and operation success rate were not mentioned. Second, the survival rate is proportional to the number of teeth instances. The bigger the number of teeth, the better the chance of survival. However, this systematic review includes a large number of small instances, and small samples often have lower accuracy and more errors. Long-term monitoring can help to boost survival rates.

Another drawback of this study was the selection of solely English language studies in three databases.

Finally, the quality of the included research was low, due to the absence of outcome measures. To improve the success of IR in clinical practice, further research on appropriate indicators and new cases are required.

CONCLUSION

The findings suggest that minimizing extra oral duration, reducing pocket depth. Choosing appropriate materials. And preventing tooth root damage are crucial for improving the success and long-term survival rates of intentional tooth replantation.

However, Intentional replantation of root canal treated tooth is a successful procedure and can be implemented successfully in clinical set ups.

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