

Intentional replantation as a last resort in the treatment of endodontic failures: Literature Review

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Keywords— Dental replantation, Endodontics, Intentional Replantation.

Abstract— One of the main objectives of endodontic treatment is the decontamination of root canal systems visando alcançar o sucesso clínico com o paciente sem sinais e sintomas. However, sometimes endodontic treatment fails, causing a periradicular inflammatory lesion to persist. Given this, there are several treatment options, including non-surgical endodontic retreatment and apical microsurgery. Sometimes these options are unfeasible, and intentional reimplantation appears as the last therapeutic option for dental element extraction. The main objective of the present study was to analyze the effectiveness of intentional replantation as a last resort in the treatment of endodontic failures. As an inclusion criterion, articles from the PubMed, Google Scholar and SciELO database were used. In PubMed, 61 articles were found, 08 were selected. In Google Scholar, 131 articles were found, 8 of which were selected for the research. In SciELO, 2 articles were found, were 2 were selected. Also 4 articles were included by cross-research. Thus, a final sample of 23 articles inserted in the work was obtained. It is concluded that intentional reimplantation is a viable alternative, but the lack of a preestablished clinical protocol makes it difficult to practice the procedure.

I. INTRODUCTION

Teeth are vital sensory organs that contribute to our daily activities (CLARK; LEVIN, 2018), such as speech, food and aesthetics in addition to assisting in living together in society. Teeth can be lost for a variety of reasons, although dental trauma and caries are the most frequent causes (CLARK; LEVIN, 2018).

According to Park (2019) when any other organ in the human body presents a high injury, a great effort is made to try to recover that organ, in contrast, and this is not observed so intensely in dentistry. This is a negative phenomenon, because the more teeth a person has, the greater the probability of having a better quality of life (PARK et al., 2019). Chewing is an important role that teeth play, and the ability to chew food is directly associated with an individual's quality of life (YAMAMOTO; SHIGA, 2018).

The intentional reimplantation is a procedure that is part of the endodontic arsenal and, like the apical endodontic microsurgery, it has technical-scientific basis and is indicated to try to save teeth (KATAOKA; GONDIM, 2020). Intentional reimplantation is indicated in cases of post-treatment periapical pathology, in which non-surgical endodontic retreatment and/or apical surgery are impractical or failed later (GRZANICH et al., 2017).

Conventional endodontic retreatment may be unfeasible either because of a complex coronary restoration that hinders access to the root canal, or because of an obstruction of the canal system that prevents access to the apical foramen, or because of the existence of a perforation whose intracanal repair is inaccessible (BECKER, 2018).

Currently, intentional reimplantation procedures involve atraumatic tooth extraction techniques, root resection and preparation, extraoral tooth manipulation for

the shortest period possible and retrofilling with biomaterials (CHO et al., 2016; GRZANICH et al., 2017).

This technique has been presented as an excellent therapeutic option, since all dental surfaces can be completely visualized and instrumented, without damaging the adjacent periodontal tissues, contributing to the reestablishment of the health of the periapical tissues. (GRZANICH et al., 2017).

Indications

In the literature several clinical indications for this technique have been presented:

1. Persistent symptomatic apical periodontitis in situations where orthograde retreatment is complicated or has failed (ASGARY et al., 2014; MAJD et al., 2014).
2. Surgical treatment has either failed or is contraindicated due to anatomic or accessibility limitations (HERRERA et al., 2006)
3. Correction of overextended root filling material with persistent disease where periapical surgery is not possible (ASGARY et al., 2014)
4. Management of resorption defects that cannot be accessed conventionally
5. Drilling in areas not surgically accessible (KATAOKA; GONDIN, 2020)

Contraindications

In the literature there are some clinical contraindications for this technique:

1. Intentional reimplantation is contraindicated if the tooth has divergent, flared and/or curved roots (ASGARY et al., 2014)
2. Tooth with vertical root fracture, presence of periodontal disease with marked mobility, insufficient clinical crown

height to allow stable application of forceps and complex root anatomy (NAGAPPA et al., 2013)

3. Use of bisphosphonate (KATAOKA; GONDIN, 2020)

4. Traumatized teeth (dental avulsion) have a high chance of developing root resorptive processes, increasing the chances of intentional reimplantation failure (KATAOKA; GONDIN, 2020).

Prognostic factors

Several critical parameters for success have been identified, including case selection, aseptic operating conditions, atraumatic extraction, extra-alveolar time, preservation of PDL cells via avoidance of chemical and mechanical trauma, initial tooth stability while maintaining the physiological movement of biocompatible root end filling material, such as mineral trioxide aggregate (MTA) and Biodentine, may enhance periapical healing (ASGARY et al., 2014).

In the literature, many authors emphasize the importance of following the following steps to increase the chances of a favorable prognosis for the patient: Minimally atraumatic extraction, maintenance of the periodontal ligament in the handling of the tooth in extraoral time, dental reimplantation, containment and stabilization of the dental element, postoperative recommendations, removal of the suture and preservation (CHO et al., 2016; CUNLIFFE et al., 2020; KATAOKA & GODIM, 2020).

However, systematic reviews and metaanalyses have indicated a survival rate of 88%-89.1% in teeth treated by IR (TORABINEJAD et al., 2015; MAINKAR, 2017). In the following table, Torabinejad et al., (2015) compare survival rates in multiple studies, resulting in an average percentage of 88% for intentionally reimplanted teeth (TORABINEJAD et al., 2015):

Table.1: Survival of the intentionally reimplanted tooth. Torabinejad et al. 2015 (TORABINEJAD et al., 2015)

TABLE 1. Evidence Table Summarizing Survival of Intentionally Replanted Teeth

Author [year] (reference)	Number of teeth	Percentage survival	95% CI lower limit	95% CI upper limit	z value	P value	Percentage resorption
Grossman [1966] (18)	45	80	67	91	14.8	<.001	18
Emmertsen and Andreasen [1966] (30)	100	81	73	88	22.4	<.001	31
Kingsbury and Wiesenbaugh [1971] (31)	149	97	93	99	33.7	<.001	5
Koenig et al [1988] (32)	177	82	76	87	30.1	<.001	4
Bender and Rossman [1993] (33)	31	81	65	93	12.4	<.001	19
Raghoobar and Vissink [1999] (34)	29	86	71	97	12.8	<.001	14
Abid [2010] (35)	20	90	72	100	11.1	<.001	35
Choi et al [2014] (36)	287	95	92	97	45.6	<.001	7
Total	838	88	81	94	24.8	<.001	11

CI, confidence interval.

II. MATERIALS AND METHODS

In order to produce a literature review, the research was carried out in databases such as Pubmed (Medical Publications), SciELO and Google Scholar. The articles

were attached in different folders by the name of the database. In PubMed the keywords (Dental replantation, Endodontics, Intencional Replantation) were used, where 61 articles were found being selected 08. In SciELO the keywords were used (Dental replantation, Endodontics,

Intencional Replantation), where 2 articles were found and 2 were selected. In Google Scholar the keywords were used (Dental replantation, Endodontics, Intencional Replantation), where 131 articles were found and 8 were selected. Also 4 articles were included by cross-research. As an inclusion criterion, a scientific article were included that contained the keywords delimited from the year 2011 until the year 2021, no language restriction.

III. RESULTS

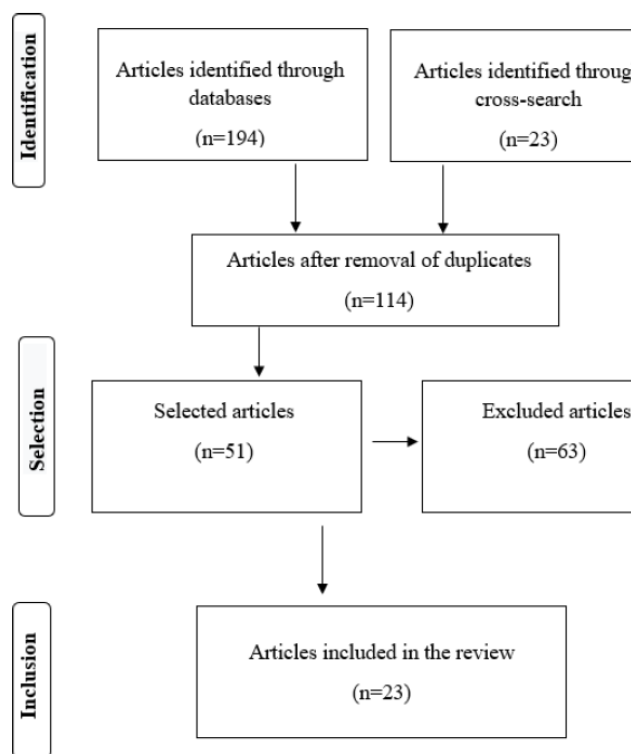


Fig.1: Articles selection process is represented in the flow diagram.

After removing the duplicates, 114 articles were obtained, from which the title and abstract were read, resulting in a total of 51 articles for full reading. From which only 19 were included, 4 articles were subsequently added by cross-reference.

IV. DISCUSSION

Intentional reimplantation is indicated in cases of post-treatment periapical pathology, in which non-surgical endodontic retreatment and/or apical surgery are impractical or failed later (GRZANICH et al., 2017).

Despite high success rates of up to 85% for primary root canal treatment, failure may still occur and new pathosis develop (NG et al., 2011). Nair (2006) discussed

predisposing factors that lead to persistence of periapical lesions following primary root canal treatment, namely: microbial intraradicular infection which might result from inadequate disinfection or coronal leakage, microbial extraradicular infection, including actinomycosis and *Propionibacterium* that can not be disinfected by conventional means, non-microbial non-radicular irritation (cholesterol crystals), exogenous non-root foreign body reaction, the true cystic lesion and surgical scar tissue. Yan et al. (2019) presented 3 case reports involving type II or type III palatogingival grooves on lateral maxillary incisors that were treated with reinsertion replantation, in all cases, the diagnosis of a combined periodontal-endodontic lesion with periodontal was made. The authors concluded that intentional replantation with a 2-segment restoration is a good therapeutic choice.

In 2015, Torabinajed et al. reported in their systematic review, a survival rate of 88% of intentionally reimplanted teeth, at two years. In this systematic review, the author compared the survival of intentionally reimplanted teeth, reported in 8 articles, with the survival of implant-supported single crowns, reported in 27 articles.

In 2016, Cho et al., also carried out a prospective study with 159 patients, mostly female and under 40 years of age, in which the majority of intentionally reimplanted teeth were second molars that presented apical radiotransparency, adequate filling and absence of fistula, most of which were retrofilled with intermediate restorative material (IRM) and reimplanted in less than 15 minutes. In this study, the author reported a cumulative retention rate of 93%, at 12 years, and a cumulative clinical and radiographic healing rate of 91%, at 6 months, which decreases to 73%, at 3 years.

In 2017, Mainkar reported a survival rate of 89.1%, in a systematic review that compared not only the survival, but also the cost-effectiveness of intentionally reimplanted teeth compared to single implants, suggesting that this is better in cases of intentional reimplantation. Furthermore, authors like Choi, Lee and Kim evaluated the effect of orthodontic extrusion provided to intentional reimplantation and its influences on survival. They observed that the survival rate of intentional replantation in its results (91%) amounted to a statistically significant way (up to 98%) with preoperative orthodontic extrusion. For rejected part, this done in had influence on further development resorption root (CHOI et al., 2014). Therefore point out this performance as a possible improvement of the prognosis of the redeployed tooth.

According to data obtained from case reports and literature reviews, all authors point out how crucial the need for the surgical act is to be minimally atraumatic,

minimizing damage to periodontal ligament (CHO el al., 2016; CUNLIFFE et al., 2020; PORTILLA et al., 2021; KATAOKA; GONDIM, 2020). The tooth must be gripped firmly using forceps holding the crown above the CEJ (CUNLIFFE et al., 2020) and dislocation should be done gently in the vestibulolingual/palatine direction, with slight rotational force to perform tooth extraction (KATAOKA; GONDIM, 2020).

The maintenance of the tooth during its extraoral time is directly realated as the success of the IR, some complications have been reported after IR treatment, such as root resorption or ankylosis; a higherrate of

complications may be associated with extra-oral preparation time exceeding 15 minutes (CHO et al., 2016). Kataoka and Gondim (2020) suggest an extraoral working time of 7 to 10 minutes associated with irrigation with the solution irrigation with the balanced solution of Hanks or Pedialyte for removal of the lesion, apicectomy, retropreparo and insertion of the MTA.

In the literature there is no standardization of a correct time for the proservation of intentional reimplantation,Cho el al., (2016) dissertation on for more than a majority of complications occurred within the first year after replantation.

Table.2: Adapted from Plotino et al, 2020 (PLOTINO et al., 2020). Intentional reimplantation in clinical studies: clinical success rate comparison

Author	Number of patients	Success rate and follow-up period
Grossman, 1996	45	80% / 5.6 years
Emmertsen & Andreasen, 1996	90	34% / 1 year
Koenig et al., 1988	192	82% (seguimiento de 6 a 51 meses)
Bender And Rossman, 1993	31	80,6% / 1 day to 22 years of follow-up
Choi et al., 2014	285	89,5% / mean follow-up of 25.4 ± 9.3 months
Asgary et al., 2014	20	90% / follow-up of 15.5 months
Cho et al., 2016	196	93% / 12 years
Jang et al., 2016	41	83,4% in 4 years and 73,0% in 11 years
Cho et al., 2017	103	89% in 1 year and 68% in 4 years

V. CONCLUSION

It can be concluded in this literature review that intentional reimplantation is a viable alternative and presents a good cost-benefit.

Despite a pattern followed by the authors in the ir achievements lack of a standard protocol for performing the procedure, further research is suggested to adapt a gold standard clinical protocol aiming at achieving the best possible prognosis.

Furthermore, it is essential that a clinician has both the knowledge, skills and equipment to undertake this procedure with safety to ensure the best possible prognosis to the patient.

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