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Success/ prognosis of endodontically re-treated teeth with the use of loupes: A systematic review

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Abstract
Aim: The aim of this systematic review was to evaluate the current literature if the prognosis/ clinical outcome of endodontically retreated teeth with the aid of loupes is more effective when treated without loupes.
Materials & Methods: Independent electronic search by 2 investigators yielded 535 titles. Records screened according to the title and selected (n=77). Records after duplicates were removed n=43. Full text articles assessed for eligibility n=34. Full text articles excluded with reasons n=19. Articles in language other than English n=9. Studies included in qualitative synthesis n=6.
Results: Six studies that met the above criteria were selected. These studies showed comparatively higher rate of success with the aid of loupes when compared to retreated teeth without loupes.
Conclusion: The magnifying loupes has been a boon to the clinicians in various aspects such as diagnosis, chair position, better visibility etc. However there is no evidence to support that the use of loupes could increase the success rate in retreatment cases.

Keywords: Retreatment, magnifying loupes, magnification

Introduction

Retreatment of root canals that have been previously filled is increasingly prevalent in the field of endodontics [1].

Inadequate cleaning and insufficient obturation are the primary factors leading to endodontic failure, necessitating the need for retreatment (Abou-Rass 1982) [2].

Out of various treatment options, orthograde retreatment should be prioritized as the primary choice (Abou-Rass 1982, Taintor *et al*. 1983, Friedman & Stabholz 1986, Lovdahl & Gutmann 1997) [3].

Nonsurgical procedures for endodontic retreatment hold significant potential for success when adhering to guidelines for case selection and employing the most appropriate technologies, top-quality materials, and precise techniques [4-6].

The success rates for orthograde retreatment are reported to range from approximately 65% (Molven 1974, Allen *et al*. 1989) to more than 80% (Strindberg 1956, Selden 1974, Sjogren *et al*. 1990) [7].

Advancements in dental equipment have enhanced clinicians' capacity to address challenging areas within the oral cavity, thereby improving the efficiency and quality of root canal treatments [8].

The introduction of magnifying equipment has advanced the visualization of root canals, providing better opportunities to locate minute canal orifices and navigate the intricate and highly complex internal anatomy of root canal morphology. Magnification enhances the details of the observed object through an optical instrument, depending on the magnifying power of that instrument [9].

Contemporary dentists have a plethora of magnification systems at their disposal, ranging from basic loupes to compound prism telescopic loupes and a diverse array of surgical microscopes. Each magnification system comes with its own set of advantages and limitations [10].

Objective

The purpose of this systematic review was to evaluate the current literature if the prognosis/ clinical outcome of endodontically retreated teeth performed with the aid of loupes is more effective than the conventional methods.

Materials & methods

Inclusion criteria & Search strategy

The Following systematic review was registered in PROSPERO (ID: 505100)

This study followed the PRISMA statement guidelines.

The following PICOS framework was used:

Population- Endodontic failure, periapical abscess, periapical granuloma

Intervention- Surgical or non-surgical endodontic retreatment

Control- Operating microscope, Endoscope

Outcomes: Primary outcome: Clinical Success, radiographic healing lesions, non healing lesions.

Study design: Clinical studies with the aid of loupes

The research question was: Is the prognosis better in endodontically retreated teeth with the aid of loupes?

Study selection

Two reviewers independently assessed the titles and abstracts of all documents. The titles and abstracts of all reports identified through the electronic searches were read.

Inclusion criteria

Prospective & retrospective clinical trials that compared endodontic retreatment procedures performed with loupes or that compared two or more magnification devices for endodontic retreatment.

Only patients who received either surgical or non-surgical endodontic retreatment and were followed up for at least 1 year after treatment were included.

Exclusion criteria

Invitro studies, Animal studies, studies involving primary teeth, studies in languages other than English were excluded.

Data extraction

For each of the identified studies included, the following data were then extracted on a standard form, when available:

These data comprised the study and year of publication, the type of study, parameters tested.

Search strategies an electronic search of articles published from January 2000 to Dec 2022 in the following databases: PubMed/Medline, Web of Science, Cochrane, Scopus and Google Scholar.

Independent electronic search by 2 investigators yielded 535 titles. Records screened according to the title and selected (n=77). Records after duplicates were removed n=43. Full text articles assessed for eligibility n=34. Full text articles excluded with reasons n=19. Articles in language other than English (n=9). Studies included in qualitative synthesis n=6.

Results

Author/year	Study design	Cases observed	Follow up years	Outcome (success rate)
Taschieri S *et al*, 2006 [11]	Randomized clinical trial	24	1 year	90.6%
Taschieri S *et al*, 2013 [12]	Retrospective study	29	4 years	90.5%
Riis A *et al*, 2018 [13]	Prospective clinical trial	92	10 years	75.5%
G Jain *et al*, 2019 [14]	Prospective clinical trial	22	1 year	80.6%
Serefoglu B, 2021[15]	Prospective clinical trial	91	2 years	88%
Chuggal *et al*, 2001	*In vivo* study	85	4 years	92.9%

According to the present systematic review the success rate of retreated teeth (surgical & non surgical) with the aid of Loupes ranges from 75.5 to 92.9%.

Discussion

The reasons for endodontic failure are often multifaceted. Contributing factors include incomplete obturation, root perforation, external root resorption, coexisting periodontal-periradicular lesions, gross overfilling or overextension of canals, unfilled canals, the formation of apical cysts, presence of adjacent pulpless teeth, inadvertent removal of silver points, broken instruments, unfilled accessory canals, persistent trauma, and nasal floor perforation [16].

The utilization of magnification devices in dentistry is increasingly prevalent, aiming to enhance the quality of treatment. Following the incorporation of microsurgical principles in endodontics, which introduced new techniques for root canal therapy, there has been a continuous pursuit to improve the visualization of the surgical field. The adoption of well-focused illumination and magnification devices has been advocated as a standard of care in endodontic therapy [17-18].

Apical periodontitis or other post-treatment diseases occur in approximately 25–35% of all teeth that have undergone root canal treatment [14]. There are three alternative treatments to manage such conditions:

- Orthograde retreatment
- Apical surgery
- Extraction of the tooth [18-19].

Data on treatment outcomes are crucial for informing decision-making processes in endodontic treatment. In cases of endodontically treated teeth exhibiting symptoms, the reported treatment outcomes play a significant role in the decision-making process, where the choice between retaining the tooth through treatment or opting for extraction is carefully considered [20].

The primary objectives of orthograde retreatment involve reestablishing access to the apical foramen through the thorough removal of root canal filling material. This process aims to facilitate adequate cleaning and shaping of the entire root canal system, ultimately leading to the final obturation [21]. Whereas, the surgical retreatment may include gaining access to the root apex, debriding it of the infected tissue and retrograde filling.

Magnifying loupes were developed to address issues such as proximity, reduced depth of field, and eyestrain that arise when getting closer to the subject [22].

Primarily, despite the widespread emphasis on the use of magnification devices within the endodontic community, the overall quality of studies on this topic is notably lacking. This aligns with recent reviews that specifically aimed to evaluate the level of evidence in the endodontic literature, highlighting the need for improved research standards [23].

The percentage of randomized studies, as well as the count of prospective non-randomized studies, is notably low for both apical surgery and orthograde endodontic treatment. A separate review by Friedman in 2004 emphasized the considerable variability in reported successful outcomes for endodontic surgery within the endodontic literature [14].

The considerable variability in reported outcomes for apical surgery in endodontic literature may be attributed, at least in part, to a multitude of factors influencing the results. These factors include various surgical procedures and materials, operator skill, adopted success criteria, experience of radiographic and clinical evaluators, patient demographics and systemic condition, tooth type, location and anatomy, size of the lesion, and follow-up duration. Consequently, the use of a specific magnification device alone may not be the sole critical determinant of treatment success [24].

Research indicates that the success rate of teeth undergoing endodontic retreatment falls within the range of 76.6% to 89% [25]. In a clinical study conducted by Torabinejad *et al*. in 2004, the success rate for endodontic surgery within the 2–4 year follow-up period was found to be 77.8%, which was higher compared to nonsurgical retreatment for the same duration, where the success rate was reported as 70.9% [26].

While numerous studies emphasize the technical advantages for clinicians associated with the adoption of magnification devices, allowing for the identification of microscopic anatomical structures otherwise invisible to the naked eye and potentially improving treatment quality, there is a notable absence of clinical evidence supporting the notion that the use of magnification directly enhances prognosis. Consequently, even though the choice of magnification device may not necessarily impact clinical outcomes, the unique technical advantages offered by each device could serve as a valuable bonus for clinicians in specific situations, potentially bolstering their self-confidence in patient care [27].

While it might appear intuitive that the use of magnification would be advantageous, contributing to increased success outcomes in dental practice, locating relevant studies that effectively demonstrate this connection remains a challenge [28].

Conclusion

The present systematic review suggests that the aid of magnification devices such as microscopic loupes helps a clinician in better diagnosis, ergonomics, visibility and patient care. However, clear evidence is not available to support that the success/prognosis of retreated cases treated with the aid of loupes can provide better results when compared to cases treated without magnification.

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