



An in Vivo Evaluation of Clinical Success and Longevity of Apicoectomy Procedure in Failed Root Canal Therapies: An Original Research Study

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KEYWORDS

Success, Longevity, Apicoectomy, Failed Root Canal, Mineral Trioxide Aggregate, Surgery, Endodontics

ABSTRACT:

Background & Aim: Apicoectomy procedure is highly recommended when conventional endodontic therapies are failed and re-rt is not advisable. Apicoectomy if performed accurately can prevent loss of teeth which would otherwise liable for extraction. In this paper (in-vivo study), authors aimed to evaluate the clinical success and longevity of apicoectomy procedure in failed root canal therapies.

Materials and Methods: This clinical study was conducted on total 40 patients (both male and female) who have undergone for apicoectomy procedure at the designated dental clinics of the city. Only single rooted teeth were chosen in the study. Local anesthesia administration was done in all cases to control intra-operative pain. The tip of the root and any infected tissues were detached and sealed with a small restoration/filling. Mineral Trioxide Aggregate (MTA) was used at all centers as root end filling material in all patients/tooth. Clinical success and longevity of apicoectomy procedure was noted at first 6 month, 12 months, 18 months timings. Results thus obtained was compiled and sent for necessary statistical analysis. P value less than 0.05 was



considered as significant ($p < 0.05$).

Statistical Analysis and Results: All statistical evaluation was completed using statistical software SPSS. Maximum 16 patients were noticed in the age range of 25-29 years. P value was highly significant here (0.01). Minimum 3 patients were found in the age range of 40-44 years. Total 23 male and 17 female patients were studied specifically. After 6 month of apicoectomy procedure, total 36 cases showed satisfactory responses to the apicoectomy procedure. P value was highly significant here (0.01). After 12 month of apicoectomy procedure, total 32 cases showed satisfactory responses to the apicoectomy procedure. After 18 month of apicoectomy procedure, total 28 cases showed satisfactory responses to the apicoectomy procedure. Evaluation amongst all 3 studied timings using one-way ANOVA revealed highly significant difference and p value (0.002).

Conclusion: Within the limitations of the study authors concluded that with the increasing post operative timing, there was clear fall of success rate and related longevity of apicoectomy procedure. There was clear drop of clinical success (up to 20-25%) of apicoectomy procedure from 6 months to 18 months post operatively. Nevertheless; authors assume few large scale future studies to be conducted in these perspectives.

Introduction

Apicoectomy procedure is also called as root end surgery or retrograde root canal treatment. It is actually an endodontic surgical therapy wherein the root apex is sectioned and root end space is prepared and later filled with some biocompatible material.^{1,2} Latest Apicoectomy procedures are performed with the help of microsurgical endodontic techniques like dental operating microscopes. These equipments enable clinician to perform highly precise Apicoectomy procedure with minimum patient discomfort.^{3,4,5} Some of the clinical challenges that clinicians encounter with Apicoectomy procedure are possible damage to the adjoining vital anatomical structures and post operative swelling and pain.^{6,7,8} Therefore many clinicians and researchers believe that Apicoectomy procedure is highly technique sensitive procedure which requires comprehensive planning and precise execution. Some of the prime requisite of end root filling material is

biocompatibility, non-toxicity.^{9,10} This end root filling material must also be maintained at its place with stability and with body temperature. Dental amalgam is most commonly used end root filing material since decades since it is user friendly and clearly revealed on the radiograph. Dental amalgam is not affected by moisture and varying body temperature. However, Dental amalgam usages have their own limitations and clinical challenges. Many researchers and clinicians in the literature has well evidenced about the different aspects of complications and advantages of Apicoectomy procedures.^{11,12,13} In this paper (in-vivo study), authors aimed to evaluate the clinical success and longevity of apicoectomy procedure in failed root canal therapies.

Materials and Methods

This clinical study was proposed, structured and conducted on total 40 patients. All 40 patients were



studied for clinical success and longevity of apicoectomy procedure performed for their failed root canal therapies. Authors have executed the study in the patients who have undergone for apicoectomy procedure at the designated dental clinics of the city. Both male and female patients were studied in detail. Only single rooted teeth (maxillary central incisors and lateral incisors) were chosen in the study. This ensured data quality and uniformity in between samples particularly about the number of multiple roots. Only one tooth per patient was selected for maintaining data consistency. Simple random sampling was used for the selection of bias free samples. Different exclusion criteria included: heart disease, kidney issue, pregnancy, anemia, psychic problems, teeth with poor periodontal apparatus, rarefaction, cysts associated with tooth, restorable tooth, proximity of neurovascular structures. Primary inclusion criteria was failed root canal therapies and other inclusion criteria were persistent infections, hidden issues, crowded roots, non-satisfactory endodontic intervention. Before starting of apicoectomy procedure, all-inclusive history was recorded including demographic details and other related findings. Written and signed informed consent was obtained from all patients. Local anesthesia administration was done in all cases to control intra-operative pain. Then a small opening was made in the gingival tissue above the tooth. The tip of the root and any infected tissues were detached. The inside region of the tooth was cleaned comprehensively and sealed with a small restoration/filling. Lastly few sutures were placed to augment the healing process. All apicoectomy procedures were completed in standard manner at all designated centers and data obtained accordingly. Mineral Trioxide Aggregate (MTA) was used at all centers as root end filling material in all patients/tooth. All patients were studied for clinical success and

longevity of apicoectomy procedure. Clinical success and longevity of apicoectomy procedure was noted in terms of Satisfactory, Non-satisfactory and Questionable statuses. It was noted at first 6 month, 12 months, 18 months timings. Authors have determined to perform this study because such clinical studies are assumed to be remarkably important to obtain complete data about personal perceptions. Clinical studies are also capable of estimating the responses of patients at personal levels. Results thus obtained was compiled and sent for necessary statistical analysis. P value less than 0.05 was considered as significant ($p < 0.05$).

Statistical Analysis and Results

All the observational notations were compiled and sent for statistical evaluation using statistical software Statistical Package for the Social Sciences version 22 (IBM Inc., Armonk, New York, USA). The obtained data was subjected to suitable statistical tests to calculate p values and other statistical inferences. Responses and outcomes were analyzed. The participants were divided into four age groups. Table 1 and graph 1 demonstrated about the Age & Gender based statistical description of contributing patients. Maximum 16 patients were noticed in the age range of 25-29 years. P value was highly significant here (0.01). Minimum 3 patients were found in the age range of 40-44 years. Total 23 male and 17 female patients were studied specifically. Table 2 illustrated about the Basic statistical description with level of significance assessment using "Pearson Chi-Square" test and interpreted as satisfactory or non-satisfactory (for success and longevity) after 6 month of apicoectomy procedure ($n=40$). Total 36 cases showed satisfactory responses to the apicoectomy procedure. P value was highly significant here (0.01). However, 2 patients each exhibited Non-satisfactory and Questionable responses.



Table 3 showed about the Basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory (for success and longevity) after 12 month of apicoectomy procedure (n=40). Total 32 cases showed satisfactory responses to the apicoectomy procedure. P value was not significant here (0.19). Total 5 cases showed Non-satisfactory responses to the apicoectomy procedure. P value was very significant here (0.02). However, 3 patient exhibited Questionable responses. Table 4 is about the Basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as

satisfactory or non-satisfactory (for success and longevity) after 18 month of apicoectomy procedure (n=40). Total 28 cases showed satisfactory responses to the apicoectomy procedure. P value was very significant here (0.01). Total 7 cases showed Non-satisfactory responses to the apicoectomy procedure. P value was not significant here (0.09). However, 5 patient exhibited Questionable responses. P value was significant here (0.02). Table 5 is about the evaluation amongst all 3 studied timings using one-way ANOVA. Assessments done Between 3 timings revealed highly significant difference and p value (0.002).

Table 1: Age & Gender based statistical description of contributing patients

Age Group (Yrs)	Male	Female	Total	P value
25-29	8	8	16	0.01*
30-34	7	4	11	0.20
35-39	6	4	10	0.50
40-44	2	1	3	0.80
Total	23	17	40	*p<0.05 Significant

Graph 1: Patients demographic assortment and related details

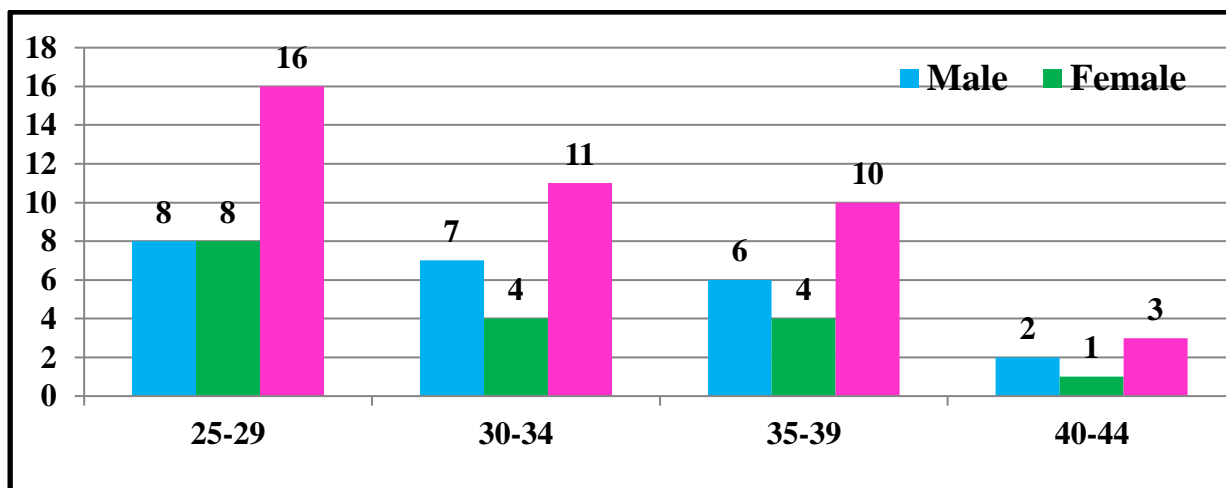




Table 2: Basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory (for success and longevity) after 6 month of apicoectomy procedure (n=40)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 6 Months								
Satisfactory	36	2.91	0.940	0.376	1.96	1.549	1.0	0.01*
Non-satisfactory	2	1.08	0.230	0.940	1.12	1.904	2.0	0.08
Questionable	2	1.08	0.230	0.940	1.12	1.904	2.0	0.08
*p<0.05 significant								

Table 3: Basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory (for success and longevity) after 12 month of apicoectomy procedure (n=40)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 12 Months								
Satisfactory	32	1.76	0.049	0.940	1.26	1.560	1.0	0.19
Non-satisfactory	5	1.22	0.230	0.524	1.12	1.921	2.0	0.02*
Questionable	3	1.09	0.890	0.870	1.19	1.424	1.0	0.09
*p<0.05 significant								

Table 4: Basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory (for success and longevity) after 18 month of apicoectomy procedure (n=40)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 18 Months								
Satisfactory	28	1.42	0.230	0.524	1.12	1.921	2.0	0.01*
Non-satisfactory	7	1.32	0.134	0.344	1.54	1.879	1.0	0.09
Questionable	5	1.22	0.230	0.524	1.12	1.921	2.0	0.02*
*p<0.05 significant								

Table 5: Evaluation amongst all 3 studied timings using one-way ANOVA

Variables	Degree of Freedom	Sum of Squares Σ	Mean Sum of Squares $m\Sigma$	F	Level of Sig. (p)
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Between 3 timings	3	2.054	1.238	1.1	0.002*
Within 3 timings	18	2.039	0.125	-	
Cumulative	121.42	12.577	*p<0.05 significant		

Discussion

Apicoectomy procedure is usually categorized as periradicular surgery that involves removal of root apex and associated surrounding infected tissues. Literature has well evidenced that apicoectomy procedure has moderate to fair clinical success rates and outcomes. Several researchers in the recent past have experimented about the different aspects of apicoectomy procedure and recommended several concepts and guidelines. Jung and associates have studied about the Volume of spaces in retrograde filling and compared between calcium silicate cement alone and combined with a calcium silicate-based sealer. Their conclusion was highly predictive and clinically applicable.¹⁴ Villa-Machado and colleagues did a retrospective follow-up evaluation on prognostic variables related with the effect of periradicular surgery. Their inferences were comparable with our results.¹⁵ Kim and associates did a prospective clinical study which evaluated about the endodontic microsurgery results for cases with lesions of endodontic origin seen with cases of combined periodontal-endodontic origin. They also stressed about the relative importance of apicoectomy procedure in re-rect cases.¹⁶ Antunes and other coworkers have studied about the sealing ability of two root-end filling materials in a bacterial nutrient leakage model. They demonstrated that the sealing ability of root-end filling materials is highly imperative in overall success and longevity of the sealing ability of two root-end filling materials.¹⁷ Nair and other researchers have reviewed on the Types and incidence of human periapical lesions obtained with extracted

teeth. They confirmed that human periapical lesions are one of the prime causes of tooth loss especially in low socioeconomic regions.¹⁸ Nair and other researchers worked on the causes of persistent apical periodontitis. Their recommendations were highly significant and comparable with our study.¹⁹ Several researchers have stated that apicoectomy procedure has highly variable success rates which solely depends upon several interrelated factors and host responses. Many studies showed that the overall success rate of apicoectomy procedure is about 77.8% in the first 2-4 years. However it is directly and indirectly affected by several factors.²⁰⁻²⁴

Conclusion

Our study results unquestionably showed the clinical status of apicoectomy procedures in studied patients. Within the limitations of the study authors concluded very critical outcomes. They concluded that apicoectomy procedure is a viable surgical option in the indicate situations however its overall success and longevity depends on several interrelated factors and host responses. In this study authors showed that with the increasing post operative timing, there was clear fall of success rate and related longevity. There was clear downfall of clinical success (up to 20-25%) of apicoectomy procedure from 6 months to 18 months post operatively. Inferences of our study should be considered as suggestive for assuming prognosis for similar clinical circumstances. However, authors expect few large scale studies to be conducted in these regards.



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