International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 1, January 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.1.2025.12

ORIGINAL RESEARCH

A Clinical Study to Evaluate the Efficacy of Apicoectomy Procedure Performed With or Without Root-End Filling: An Original Research Study

Dr. Mohsin Bilal[1], Dr. Prateek Maheshwari[2], Dr. Shalini Singh[3], Dr. Iram Saba[4], Dr. Pinky Rana[5], Dr. Pooja Arya[6]

[1]Associate Professor, [2]Assistant Professor, [3]Senior Lecturer, Department of Dentistry, Venkateshwara Institute of Medical Sciences, Rajabpur, Jyotiba Phule Nagar, Uttar Pradesh, India
[4]Senior Resident, Department of Dentistry, Shri Siddhi Vinayak Medical College, Bhawanipur, Sambhal, Uttar Pradesh, India
[5]Post Graduate Student, Department of Oral and Maxillofacial Surgery, Kothiwal Dental College & Research Centre, Moradabad, Uttar Pradesh, India
[6]Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics, Uttaranchal Dental and Medical Research Institute, Haridwar Road, Dehradun, Uttarakhand, India

Corresponding Author
Dr. Prateek Maheshwari
Assistant Professor, Department of Dentistry, Venkateshwara Institute of Medical Sciences, Jyotiba Phule Nagar, Uttar Pradesh, India

Received: 17 November, 2024 Accepted: 20 December, 2024 Published: 08 January, 2025

ABSTRACT

Background & Aim: Apicectomy is the surgical removal of the apical portion of the tooth and the attached soft tissues during periapical surgery. Presence and absence of Root-End Filling material have their own effects on the overall efficiency of apicoectomy procedure. This study was aimed to evaluate the efficacy of apicoectomy procedure performed with or without root-end filling. **Materials and Methods:** In this clinical study, both male and female patients were selected for planned evaluations. All 40 patients were studied into 2 major groups. Group 1 has 20 patients wherein apicoectomy procedure was attempted with root-end filling materials (MTA: Mineral Trioxide Aggregate). Group 2 has 20 patients wherein apicoectomy procedure was attempted without root-end filling materials. Written and signed informed consent was obtained from all patients. Patient called after twelve days for surgical follow up. Satisfactory, Non-satisfactory and Questionable responses were seen and assessed after 2 months and 4 months timings post operative timings. Results thus obtained was compiled and sent for basic statistical analysis. P value less than 0.05 was considered as significant ($p< 0.05$). **Statistical Analysis and Results:** 15 patients were noticed in the age range of 24-25 years. P value was highly significant here (0.02). 5 patients were found in the age of 30 years. Total 23 male and 17 female patients were studied particularly. For Group 1, 17 patients were satisfied as and P value was highly significant here (0.01). Only 2 patients were not satisfied and 1 patient showed questionable response. For Group 1 noted after 4 months, 16 patients were satisfied as and P value was not significant here (0.17). Only 3 patients were not satisfied. The evaluation amongst all 2 Groups using one-way ANOVA showed highly significant difference and p value (0.001). **Conclusion:** Within the limitations of the study authors have concluded that apicoectomy procedure is a feasible option and offer patient satisfaction. In this study, high therapeutic satisfaction was identified in the patients of apicoectomy with root-end filling. This was observed in both of the tested post operative follow up timings. Patients with Apicoectomy without root-end filling expressed lower level of therapeutic satisfaction in both of the tested post operative follow up timings.

Keywords: Esthetics, Endodontic Treatment, Apicoectomy, Root-End Filling, Surgery, Satisfaction

INTRODUCTION

Apicoectomy process is also known as root end surgery or retrograde root canal intervention. It is actually an endodontic surgical treatment in which the root apex is resected and root end space is made and later filled with some inert material.[1-2] Most recent Apicoectomy therapies are conducted with the assistance of microsurgical endodontic performances e.g. dental operating microscopes. Such kind of sophisticated and accurate instruments allows operator

DOI: 10.69605/ijlbpr_14.1.2025.12

to deliver highly defined Apicoectomy with minimum complications.[3-4] Endodontic therapy is performed to maintain pulp vitality or treat necrotic pulp to maintain the tooth. Routine apicectomy with root-end filling has also been recommended when canal access is blocked by calcification, post or broken instruments. Some of the major essentialities of end root filling material is its biocompatibility and non-toxic nature.[5-7] Dental amalgam is most frequently used end root filing material since many years because it is non complicated and evidently exposed on the radiograph. Dental amalgam is not exaggerated by unstable body temperature. Many researchers and clinicians in the literature has well experimented about the various characteristics and advantages of Apicoectomy procedures. Hence, this study was conducted to evaluate the efficacy of apicoectomy procedure performed with or without root-end filling.

MATERIALS AND METHODS

This clinical study was proposed, prepared and performed on total 40 patients selected in the department. The basic ideology was to investigate the effects of root-end filling materials on the overall efficiency of apicoectomy procedure. Both male and female patients were selected in the study for planned evaluations. Simple random sampling was used for the selection of bias free samples. Various exclusion criteria included: restorable tooth, non favorable root length and poor periodontal support, poor oral hygiene habits, uncooperative patients, patients with severe ongoing systemic disease, psychic problems, cysts related with tooth. Primary inclusion criteria were failed root canal treatment wherein extraction is to be avoided. Other inclusion criteria were acceptable patient compliance, satisfactory follow ups and non smokers. All 40 patients were studied into 2 major groups. Group 1 has 20 patients wherein apicoectomy procedure was attempted with root-end filling materials (MTA: Mineral Trioxide Aggregate). Group 2 has 20 patients wherein apicoectomy procedure was attempted without root-end filling materials. Complete case history was recorded including demographic details and other interrelated findings. Written and signed informed consent was obtained from all patients. During apicoectomy procedure, local anesthesia administration was done in all cases to control intra-operative pain. Infiltration or nerve block wherever is needed administered by using 2% Lignocaine with 1:200000. Root-end filling material was filled later in intended cases. Patient called after twelve days for surgical follow up. The general esthetic and patient factors like functional acceptance, asymptomatic condition, pleasure, relieve, public acceptance was noted in terms of Satisfactory, Non-satisfactory and Questionable grades. It was seen and assessed after 2 months and 4 months timings post operative timings. Results thus obtained was compiled and sent for basic statistical analysis. P value less than 0.05 was considered as significant ($p< 0.05$).

STATISTICAL ANALYSIS AND RESULTS

All the feasible findings were identified and sent for statistical evaluation using statistical software Statistical Package for the Social Sciences version 22 (IBM Inc., Armonk, New York, USA). The resultant data was subjected to proper statistical tests to calculate p values and other statistical inferences. Responses and results were processed judiciously. The patients were studied into four age groups. Table 1 and Graph 1 confirmed about the Age & Gender based statistical explanation of the patients. Maximum 15 patients were noticed in the age range of 24-25 years. P value was highly significant here (0.02). Minimum 5 patients were found in the age of 30 years. Total 23 male and 17 female patients were studied particularly. Graph 2 explained in detail about the representation of Mean, SD (Group 1, n=20 patients, noted after 2 month) wherein Graph 3 expressed about the representation of Mean, SD (Group 1, n=20 patients, noted after 4 month). 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 or Questionable. It was for Group 1, n=20 patients wherein apicoectomy procedure was attempted with root-end filling materials MTA: Mineral Trioxide Aggregate and noted after 2 months. Maximum 17 patients were satisfied as per predetermined satisfactory criteria. P value was highly significant here (0.01). Only 2 patients were not satisfied and 1 patient showed questionable response. Table 3 illustrated about the fundamental statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory or Questionable. It was for Group 1, n=20 patients wherein apicoectomy procedure was attempted with root-end filling materials MTA: Mineral Trioxide Aggregate and noted after 4 months. Maximum 16 patients were satisfied as per predetermined satisfactory criteria. P value was not significant here (0.17). Only 3 patients were not satisfied (P value was highly significant here: 0.02) and 1 patient showed questionable response. Table 4 illustrated about the basic statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory or Questionable. It was attempted for Group 2, n=20 patients wherein apicoectomy procedure was attempted without root-end filling materials and noted after 2 months. Maximum 14 patients were satisfied as per predetermined satisfactory criteria. P value was significant here (0.01). Only 4 patients were not satisfied (P value was not significant here: 0.24) and 2 patient showed questionable response. Table 5 demonstrated about the fundamental statistical description with level of significance assessment using “Pearson Chi-Square” test and interpreted as satisfactory or non-satisfactory or Questionable. It was for Group 2, n=20 patients wherein apicoectomy

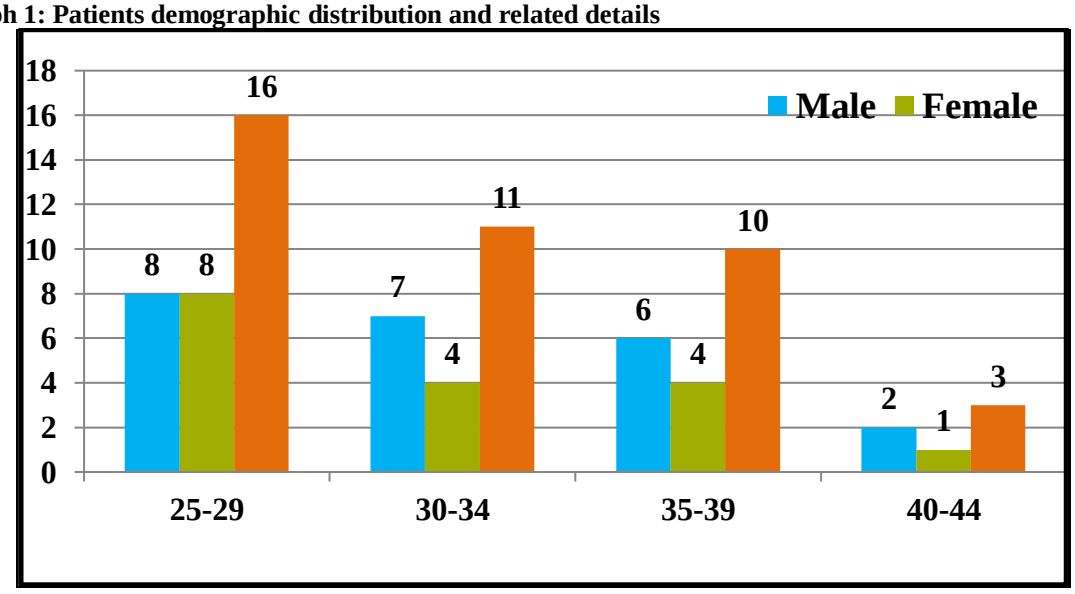
DOI: 10.69605/ijlbpr_14.1.2025.12

procedure was attempted without root-end filling materials and noted after 4 months. Maximum 13 patients were satisfied as per predetermined satisfactory criteria. P value was significant here (0.01). Only 6 patients were not satisfied (P value was not significant here: 0.08) and 1 patient showed questionable response. Table 6 is about the evaluation amongst all 2 Groups using one-way ANOVA. Assessments done Between 2 Groups, Within 2 Groups and Cumulative revealed highly significant difference and p value (0.001).

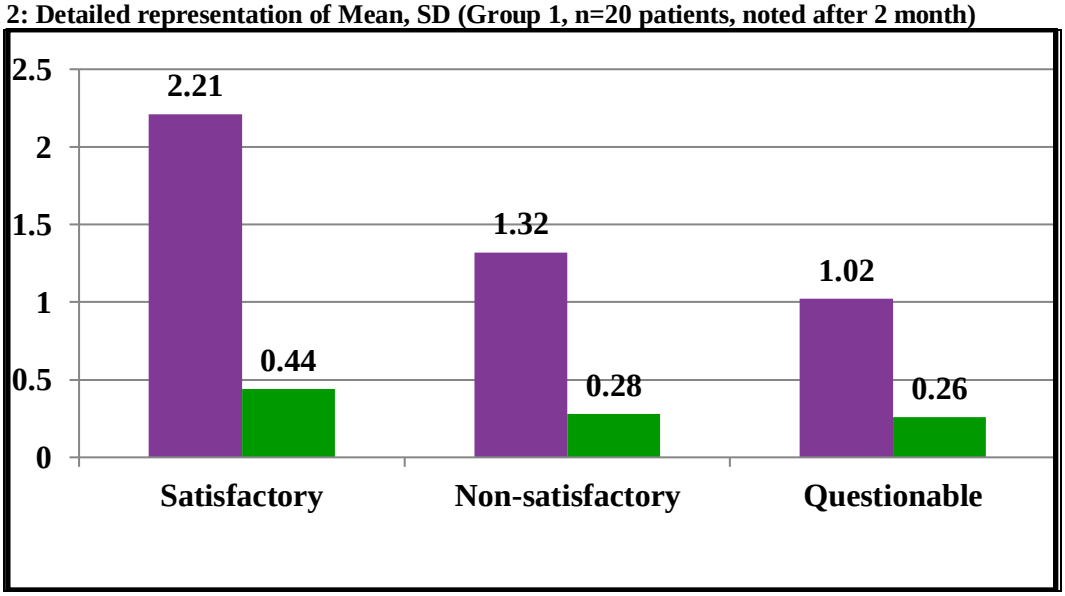
Table 1: Age & Gender based statistical description of contributing patients

Age Group (Yrs)	Male	Female	Total	P value
24-25	7	8	15	0.02*
26-27	8	4	12	0.30
28-29	5	3	8	0.80
30	3	2	5	0.10
Total	23	17	40	***p<0.05 Significant**

Graph 1: Patients demographic distribution and related details



Graph 2: Detailed representation of Mean, SD (Group 1, n=20 patients, noted after 2 month)



DOI: 10.69605/ijlbpr_14.1.2025.12

Graph 3: Detailed representation of Mean, SD (Group 1, n=20 patients, noted after 4 month)

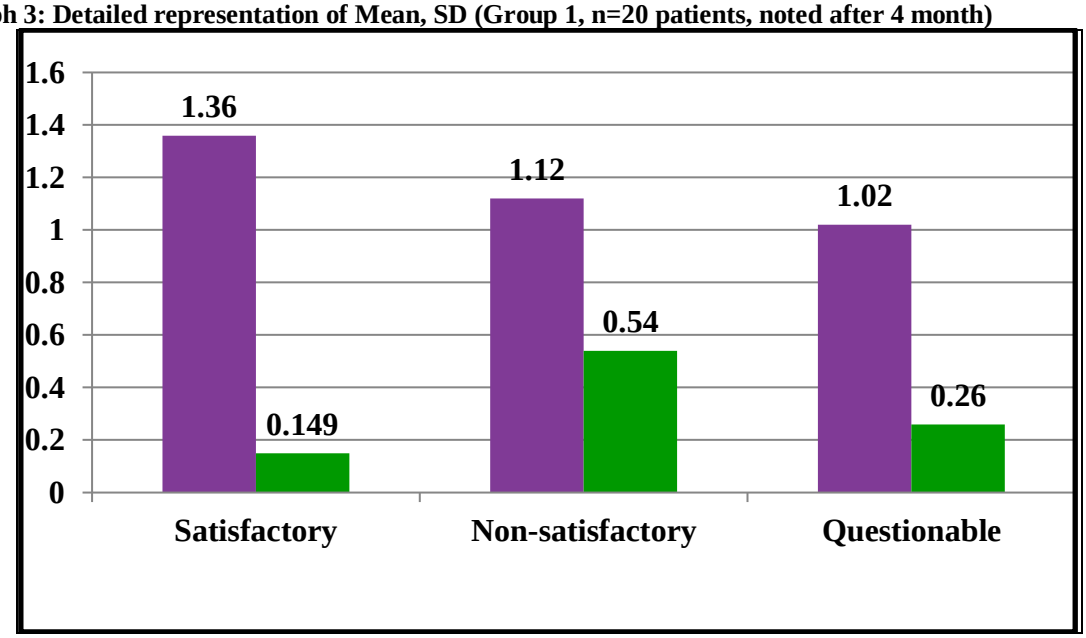


Table 2: Fundamental statistical description with level of significance assessment using "Pearson Chi-Square" test and interpreted as satisfactory or non-satisfactory or Questionable (Group 1, n=20 patients wherein apicoectomy procedure was attempted with root-end filling materials MTA: Mineral Trioxide Aggregate, noted after 2 months)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 2 Months Post Operative Follow-up Timings								
Satisfactory	17	2.21	0.440	0.476	1.36	1.449	1.0	0.01*
Non-satisfactory	2	1.32	0.280	0.540	1.62	1.124	2.0	0.06
Questionable	1	1.02	0.260	0.650	1.82	1.984	2.0	0.08
***p<0.05 significant**								

Table 3: Fundamental statistical description with level of significance assessment using "Pearson Chi-Square" test and interpreted as satisfactory or non-satisfactory or Questionable (Group 1, n=20 patients wherein apicoectomy procedure was attempted with root-end filling materials MTA: Mineral Trioxide Aggregate, noted after 4 months)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 4 Months Post Operative Follow-up Timings								
Satisfactory	16	1.36	0.149	0.140	1.86	1.860	1.0	0.17
Non-satisfactory	3	1.12	0.540	0.114	1.12	1.621	2.0	0.02*
Questionable	1	1.02	0.260	0.650	1.82	1.984	2.0	0.08
***p<0.05 significant**								

Table 4: Fundamental statistical description with level of significance assessment using "Pearson Chi-Square" test and interpreted as satisfactory or non-satisfactory or Questionable (Group 2, n=20 patients wherein apicoectomy procedure was attempted without root-end filling materials, noted after 2 months)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 2 Months Post Operative Follow-up Timings								
Satisfactory	14	1.32	0.330	0.424	1.12	1.541	2.0	0.01*
Non-satisfactory	4	1.72	0.834	0.654	1.84	1.349	1.0	0.24
Questionable	2	1.28	0.240	0.514	1.42	1.321	2.0	0.12
***p<0.05 significant**								

DOI: 10.69605/ijlbpr_14.1.2025.12

Table 5: Fundamental statistical description with level of significance assessment using "Pearson Chi-Square" test and interpreted as satisfactory or non-satisfactory or Questionable (Group 2, n=20 patients wherein apicoectomy procedure was attempted without root-end filling materials, noted after 4 months)

Status	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square	df	p value
After 4 Months Post Operative Follow-up Timings								
Satisfactory	13	1.34	0.270	0. 724	1.42	1.331	2.0	0.01*
Non-satisfactory	6	1.37	0.194	0.387	1.84	1.829	1.0	0.08
Questionable	1	1.02	0.260	0.650	1.82	1.984	2.0	0.08
***p<0.05 significant**								

Table 6: Evaluation amongst all 2 Groups using One-Way ANOVA

Variables	Degree of Freedom	Sum of Squares ∑	Mean Sum of Squares m∑	F	Level of Sig.(p)
Between 2 Groups	4	1.024	1.158	1.7	0.001*
Within 2 Groups	14	2.349	0.545	-	
Cumulative	131.12	11.237	***p<0.05 significant**		

DISCUSSION

Apicoectomy is the most common surgical endodontic interventional procedure. Apicoectomy frequently involves periapical curettage, root-end removal, root-end shaping and root-end restorations.[8-10] Endodontic failure is somewhat common entity and it necessitates re-treatment rather than removal of whole teeth. Re-treatment typically involves conservative or surgical endodontic intervention.[11-13] In the recent past, no root-end sealing materials have been found to absolutely close the apex from periapical structures.[14-15] Thomas and associates have conducted a Meta analysis on the prognostic factors in apical surgery with root-end filling. Their conclusion was in accordance with our inferences. They also confirmed the judicial usage of root end filling materials in the long term success of this apicoectomy therapies.[16] Christiansen and colleagues have conducted a randomized clinical trial of root end resection followed by root-end filling with mineral trioxide aggregate or smoothing of the ortho-grade gutta-percha root filling 1-year follow-up. They also stressed on the imperative role of root end filling material in apicoectomy therapies.[17] Hasouni and other researchers have evaluated the success rate of apicectomy of anterior and premolar teeth. Their results were highly comparable and predictive with clinical results.[18] Locurcio and associates have presented a case report on the periradicular surgery; apicoectomy and obturation of the apex. They also highlighted the imperative role of the root end filling material in the overall success and satisfaction of patient.[19] These factors perhaps enlighten the higher failure rate of root-end restored teeth compared with those without root-end restorations.[20-24] Many other researchers have conducted somewhat similar studied and presented exiting results. Literature has also shown the studies those have accounted higher success rates in apicectomy with retrograde root-end filling.[25-30] Most of these types of studies advocate the positioning of root-end filling particularly when an ineffective endodontic treatment was improved by an apicectomy rather than by re-treatment.[13,23,28,31-35]

CONCLUSION

Within the limitations of the study it has been concluded that apicoectomy procedure is a viable option and offer maximum outcome and patient satisfaction in almost every aspect. Apicoectomy procedure augmented with root-end filling is also a vital approach in most of the indicated situations. In this study, high therapeutic satisfaction was identified in the patients of apicoectomy with root-end filling. This was observed in both of the tested post operative follow up timings. Patients with Apicoectomy without root-end filling expressed lower level of therapeutic satisfaction in both of the tested post operative follow up timings. However, the overall success depends on several interrelated factors and patient responses. Observations of this study must be considered as indicative for estimating prognosis for similar clinical circumstances.

REFERENCES

1. Park JH, Kim HJ, Lee KW, Yu MK, Min KS. Push-out bond strength and intratubular biomineralization of a hydraulic root-end filling material premixed with dimethyl sulfoxide as a vehicle. Restor Dent Endod. 2023 Jan 20;48(1):e8.
2. Azhar S, Manan R, Bansal N, Singh D, Chauhan B. Comparison of the Microleakages of Four Root-End Filling Materials: An In Vitro Study. Cureus. 2023 Jun 15;15(6):e40461.
3. Omar N, Abdelraouf RM, Hamdy TM. Effect of different root canal irrigants on push-out bond strength of two novel root-end filling materials. BMC Oral Health. 2023 Apr 2;23(1):193.
4. Dong X, Xie Q, Xu X. In vitro evaluation of the sealing ability of combined use of iRoot BP Plus and iRoot SP for root-end filling. Clin Oral Investig. 2023 Jun;27(6):2969-2977.
5. Jimenez-Bueno I, Garcia-Contreras R, Aranda-Herrera B, Sakagami H, Lopez-Ayuso CA, Nakajima H, Jurado CA, Nurrohman H. Cytotoxicity, Differentiation, and Biocompatibility of Root-End Filling: A

DOI: 10.69605/ijlbpr_14.1.2025.12

Comprehensive Study. Biomimetics (Basel). 2023 Oct 29;8(7):514.
6. Gutman JL. 4th Edition. Boston, USA: Reed Educational and Professional Publishing Ltd; 1997. Surgical Endodontics Harty s Endodontics in clinical practice; pp. 144–190.
7. Siqueira JF., Jr Reaction of periapical tissues to root canal treatment; benefits and drawbacks. Endod Tropics . 2005;10:123–147.
8. Kumar P, Rastogi S, Kumar A, Goel R. Impact factor-the reputation gauge of the journals: An overview. Eur J Gen Dent 2012;1(2):121.
9. Kumar P, Dammani B, Mahajani M, et al. A Two-Year Follow-Up Assessment of Decreasing Crestal Bone Levels Around Dental Implants in Patients Rehabilitated With Mandibular Implant Overdentures. Cureus J Med Sci 2022;14(9):e29044.
10. Rapp El, Brown CE , Jr, Newton CW. An analysis of success and failure of apicoectomies. J Endod. 1991;17:508–512.
11. Rud J, Andreasen JO, Moller Jensen JE. Radiographic criteria for the assessment of healing after endodontic surgery. Int J Oral Surg. 1972; 1:195–214.
12. Pe arrocha-Diago M, Ortega-S nchez B, Garc a-Mira B, Mart -Bowen E, Von Arx T, Gay-Escoda C. Evaluation of healing criteria for success after periapical surgery. Med Oral Patol Oral Cir Bucal. 2008 Feb1; 13(2):E143–147.
13. Kumar P, Goel R, Jain C, Kumar A, Parashar A, Gond AR. An overview of biomedical literature search on the World Wide Web in the third millennium. Oral Health Dent Manag 2012;11(2):83-9.
14. Kolude B, Gbadebo S.O. Orofacial pain; Pattern of presentation at dental clinic University College Hospital, Ibadan. MDS Thesis. 2007.
15. Mohammed KH, Shehab AH. Success rate of apicectomy of anterior and premolar teeth. Al-Rafidain Dent J . 2005;5(2):161–167.
16. Thomas von Arx. Miguel Pen arrocha, Storga rd Jensen. Prognostic factors in apical surgery with root-end filling: A Meta-analysis. J Endod . 2010;36:957–973.
17. Christiansen R, Kirkevang LL, H rsted-Bindslev P, Wenzel A. Randomized clinical trial of rootend resection followed by root-end filling with mineral trioxide aggregate or smoothing of the orthograde gutta-percha root filling 1-year follow-up. Int Endod J . 2009;42:105–114.
18. Hasouni MKh, Hamad ShA. Success rate of apicectomy of anterior and premolar teeth. Al Rafidain Dent J . 2005;5(2):161–167.
19. Locurcio LL, Leeson R. A case of periradicular surgery; apicoectomy and obturation of the apex, a bold act. Stomatological Dis Sci . 2017;1:76–80.
20. Kumar P, Khattar A, Goel R, Kumar A. Role of Botox in Efficient Muscle Relaxation and Treatment Outcome: An Overview. Ann Med Health Sci Res 2013;3(1):131.
21. Kumar P, Fatima N, Ramesh G, et al. An In Vitro Assessment of Marginal Accuracies in Copings Fabricated With Two Dissimilar Alloys: An Original Research Study. Cureus J Med Sci 2022;14(8):1-5.
22. Gary B. Carrs, Scott K Bentkover. Surgical Endodontics. In: Cohen S, Burns RC, editors. Pathways of the pulp. St Louis: CV Mosby Co; 1998. pp. 608–656.
23. Kumar P. Imperative role of internet in biomedical literature search and data collection: An update. J Prim Care Dent Oral Health 2022;3:85-6.
24. Kumar P. 'Platform switching preserve crestal bone loss around dental implants'; a factual myth or truth: Answer is not single. Eur J Prosthodont 2013;1(2):47-8.
25. Kumar P. Osteopromotion to enhance bone volume in implant rehabilitative therapies: An insight. Eur J Prosthodont 2013;1(3);71.
26. Grung B, Molven O, Halse A. Periapical surgery in a Norwegian Country Hospital; Follow-up findings of 447 teeth. J Endod. 1990;16:411–417.
27. Oginni AO, Adekoya-Sofowora CA. Pulpal sequelae after trauma to anterior teeth among adult Nigerian dental patients. BMC Oral Health . 2007;7:11. doi: 10.1186/1472-6831-7-11.
28. Kumar P. Imperative role of surgical templates in accurate implant positioning: A key to success. Eur J Prosthodont 2013;1(3);69-70.
29. Kumar P, Khattar A, Goel R, Kumar A. Nanotechnological impact on future clinical dental prospects: An insight. Eur J Gen Dent 2013;2(1):87-8.
30. Kumar P, Singh HP, Kumar A, Goel R. Dental treatment modifications in thyroid disorders: An overview. Thyroid Res Practice 2012;9(3):105.
31. Knapp J, Kirkpatrick T, Ontiveros JC, Jaramillo DE, Kim HC, Jeong JW. Efficacy of root-end filling techniques using premixed putty type bioceramic cements: an ex vivo study. Clin Oral Investig. 2024 Jun 8;28(7):365.
32. Kumar P, Rastogi J, Jain C, Singh HP. Prosthodontic management of worn dentition in pediatric patient with complete overlay dentures: a case report. J Adv Prosthodont 2012;4(4):239-42.
33. Aksu S, Delikan E, Küçük AÖ, Asoğlu ZD, Yılmaz ŞN. The osteoinductive potential of different root-end filling materials in a rat femur model. Sci Rep. 2024 Jan 24;14(1):2078.
34. Ku JK, Jeon WY, Ko SO, Yoon JY. Assessing the efficacy of apicoectomy without retrograde filling in treating periapical inflammatory cysts. J Korean Assoc Oral Maxillofac Surg. 2024 Jun 30;50(3):140-145.
35. Hseen AB, Nassif QK, Maarawi K, Haffaf RA, Khaddam M. A Comparison of the Apical Sealing Efficacy Between Guttaflow Bioseal and Mineral Trioxide Aggregate as Root-End Filling Materials: An In Vitro Study. Cureus. 2024 Nov 12;16(11):e73498.