
Occurrence of Additional Canals in Mandibular Lower Anteriors In Between Male and Female Patients

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Abstract: The endodontic treatment with excellent outcomes depends on the critical identification of the root and its canals anatomy. The successful identification of these anatomies guaranteed the pulp tissue extirpation completely, with efficiency in chemo-mechanical cleaning and shaping. All these lead to the most proper three-dimensionally root canal obturation with the most reliable inert filling. The purpose of this study is to provide clinical data on the presence of additional canals in mandibular anterior teeth among males and females. Patients reported from June 2019 to March 2020 were reviewed. 82000 patient records were reviewed and data related to patients undergone Root canal therapy in mandibular lower anteriors. Data includes age, gender and number of additional canals in lower anteriors. The collected data was tabulated in the excel sheet. Statistical analysis was done using SPSS software (version 9.0.3). The prevalence of patients with additional canals in mandibular anteriors was 8.1% . For females, the prevalence of additional canals was 3.24% whereas in males it is 4.86%. However, there is no relation between the gender and presence of additional canals in mandibular anteriors.

Keywords: Gender; Innovation technique; Mandibular anteriors; Root canal morphology; Root canal treatment.

INTRODUCTION

Success of an endodontic treatment largely depends on proper cleaning and shaping of the entire root canal system. (Vertucci, 2005) Detailed understanding of the root canal anatomy and configuration is important. Many of the problems encountered during and after root canal treatment occur because of inadequate understanding of the pulp space anatomy.

Studies on the internal and external anatomy of teeth have shown that anatomic variations can occur in all groups of teeth and can be extremely complex. (Boruah and Bhuyan, 2011) However, an important challenge is the complexity of the root canal system and anatomical variations. (Rahimi and Ghasemi, 2013) Therefore, the clinician should be aware of typical configuration and potential anatomical variations. In this case, the possibility of treatment failure due to untreated canals decreases.

Dentists must be familiar with the various root canal configurations and their characteristic features in different racial groups. Such awareness can help locate and negotiate canals, as well as in their subsequent management. (Rahimi et al., 2008) A good anticipation of their possible anatomical variation will help lessen endodontic failure. (Siqueira and Rôças, 2008) For each tooth in the permanent dentition, there is a wide range of variation reported in the literature.

There are many in vitro studies and clinical methods used in studies for evaluating the root canal morphology such as ex vivo radiography, decalcification, (Okumura, 1927) dye injection, (Yew and Chan, 1993) in vitro macroscopic examination, examination of the pulpal floor with electron microscope and ground sectioning. Clinical methods include evaluation of endodontic access openings during endodontic treatment using magnification with a surgical operating microscope, or during endodontic treatment where magnification was not specified, or retrospective evaluation of endodontically treated teeth in patient records, or radiography of all teeth and in vivo radiographic examination.

Conventional periapical radiographs are valuable diagnostic tools for assessing root canal morphology in vivo. Nevertheless, these radiographs are not absolutely reliable because of inherent limitations such as the distortion and superimposition of bony and dental structures that can occur in the taken images. There are a number of

ways in order to decrease the possibility of missed root canals starting with good pre-operative radiographies. There are several limitations in conventional radiographies. In order to overcome that, cone-beam computed tomography (CBCT) can be used in identifying the presence of additional canals.

A correct access cavity preparation is also very important in localizing the orifices of the root canals. Apart from that, ultrasonics are very important devices to identify missed canals. Increasing magnification and illumination enhance the possibility of finding all root canals during root canal treatment.

Previously our team had conducted numerous studies which include in vitro studies (Siddique and Jayalakshmi, 2019) (Website, no date; Rajendran et al., 2019) (Teja, Ramesh and Priya, 2018)(Janani, Palanivelu and Sandhya, 2020)(Teja and Ramesh, 2019)(Nasim and Nandakumar, 2018), review (R, Rajakeerthi and Ms, 2019)(Kumar and Delphine Priscilla Antony, 2018)(Ravinthar and Jayalakshmi, 2018), survey (Jose, P. and Subbaiyan, 2020)(Manohar and Sharma, 2018), clinical trial(Ramamoorthi, Nivedhitha and Divyanand, 2015)(Hussainy et al., 2018) . The idea for this study stemmed from the current interest in our community. Our department is passionate about research we have published numerous high quality articles in this domain over the past years ((Kavitha et al., 2014) , (Praveen et al., 2001),(Devi and Gnanavel, 2014), (Putchala et al., 2013), (Vijayakumar et al., 2010), (Lekha et al., 2014a, 2014b) (Danda, 2010) (Danda, 2010) (Parthasarathy et al., 2016) (Gopalakannan, Senthilvelan and Ranganathan, 2012), (Rajendran et al., 2019), (Govindaraju, Neelakantan and Gutmann, 2017), (P. Neelakantan et al., 2015), (PradeepKumar et al., 2016), (Sajan et al., 2011), (Lekha et al., 2014a), (Neelakantan, Grotra and Sharma, 2013), (Patil et al., 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab et al., 2017), (Eapen, Baig and Avinash, 2017), (Menon et al., 2018), (Wahab et al., 2018), (Vishnu Prasad et al., 2018), (Uthrakumar et al., 2010), (Ashok, Ajith and Sivanesan, 2017), (Prasanna Neelakantan et al., 2015). Hence, the present study intends to evaluate the gender association in occurrence of additional canals in mandibular anteriors.

MATERIALS AND METHODS

Study Setting

This retrospective study was conducted under a hospital based university setting

Ethical Approval

Ethical permission and approval for the project was obtained from the Institutional Review Board of Saveetha Institute of Medical and Technical Sciences, Chennai, India on Date 25/04/2020.

Inclusion criteria

The patients who had undergone treatment for Root canal therapy in relation to mandibular anteriors.

Exclusion criteria

Treatment procedures apart from Root canal therapy in relation to mandibular anteriors were excluded from the study.

Data Collection

Patients reported from June 2019 to March 2020 were reviewed. 82000 patient records were reviewed and data related to patients undergone Root canal therapy in mandibular lower anteriors. Data includes age, gender and number of additional canals in lower anteriors. The collected data was tabulated in the excel sheet. Statistical analysis was done using SPSS software (version 9.0.3).

Statistical Analysis

The descriptive statistics were used to determine the frequencies and percentage of the gender and age of the patients who had undergone root canal therapy in mandibular lower anteriors . Chi square test was used to evaluate the gender association in occurrence of additional canals in mandibular anteriors. The outcome data was represented in the form of a bar graph.

RESULTS AND DISCUSSION

A total of 740 patients were seen during the study period. The prevalence of patients with additional canals in mandibular anteriors was 8.1% (60 of 740). For females, the prevalence of additional canals was 3.24% (24) whereas in males it is 4.86% (36) [Figure 1,2]. The results show that there is no significant difference between genders and the presence of additional canals in mandibular anteriors ($P>0.05$) [Figure 3].

Based on the previous article, a research conducted by Boruah LC et al, (Boruah and Bhuyan, 2011) reveals that the majority of the mandibular incisors had a single root canal with 63.75% and only 36.25% of the roots had additional canal which is similar to our study.

In another study by Al-Qudah et al, (Al-Qudah and Awawdeh, 2006) the majority of the mandibular incisors had a single root canal (73.8%) and 28.22% only had two canals, correlating to our study. Similarly a study

conducted by Al Fouzan KS et al (Al-Fouzan et al., 2012) showed that 70% of the mandibular central and lateral had more than one main canal and one apical foramen while 30% of the sample had two separate canals merged into one canal before exiting.

Jia Liu et al reported that permanent mandibular incisors with two canals had a relatively low incidence in this Chinese population. The incidence of a second canal did not differ between males and females.(Liu et al., 2014) In a study done by Ezoddini et al it was found that 55.9% of the teeth had two canals that in 51.5% of them the canals merged into one canal before exiting the tooth through one apical foramen.(Ezoddini, Mohammadi and Tabrizzadeh, 2008).

Mohsen Aminsobhan et al reported the majority of mandibular central, lateral incisors and canines had one canal which is 72.7%, 70.6% and 71.8%, respectively.(Aminsobhani et al., 2013) Shape of the root canal is highly specific to each individual. Automated identification methods of the medial line of dental root canals and the reproduction of their 3D shape can be beneficial for endodontic interventions planning as severely curved root canals or multi-rooted teeth may pose treatment challenges. Accurate shape information of the tooth root canals may also be used by manufacturers of endodontic instruments in order to make more efficient clinical aids.

Present Study has a limitation of sample size, unicentric study (Saveetha Dental College).In Future scope, similar study with larger sample size and multicentered study has to be conducted to attain appropriate results.

CONCLUSION

In this study there is no relation between the gender and presence of additional canals in mandibular incisors. However, it is necessary to carefully interpret radiographic images prior to the root canal treatment. Anatomical identification is necessary to avoid the missed canal which leads to root canal failure.

ACKNOWLEDGMENT

The authors of this study acknowledge the institute, for their help towards collecting all the patient case records and other datas in relevance to the current study.

Conflict of Interest

The authors declare no conflicts of interest

REFERENCES

1. Abdul Wahab, P. U. et al. (2017) 'Risk Factors for Post-operative Infection Following Single Piece Osteotomy', *Journal of maxillofacial and oral surgery*, 16(3), pp. 328–332.
2. Al-Fouzan, K. S. et al. (2012) 'Incidence of two canals in extracted mandibular incisors teeth of Saudi Arabian samples', *Saudi Endodontic Journal*, 2(2), p. 65.
3. Al-Qudah, A. A. and Awawdeh, L. A. (2006) 'Root canal morphology of mandibular incisors in a Jordanian population', *International endodontic journal*, 39(11), pp. 873–877.
4. Aminsobhani, M. et al. (2013) 'Evaluation of the root and canal morphology of mandibular permanent anterior teeth in an Iranian population by cone-beam computed tomography', *Journal of dentistry*, 10(4), pp. 358–366.
5. Ashok, B. S., Ajith, T. A. and Sivanesan, S. (2017) 'Hypoxia-inducible factors as neuroprotective agent in Alzheimer's disease', *Clinical and experimental pharmacology & physiology*, 44(3), pp. 327–334.
6. Boruah, L. C. and Bhuyan, A. C. (2011) 'Morphologic characteristics of root canal of mandibular incisors in North-East Indian population: An in vitro study', *Journal of conservative dentistry: JCD*, 14(4), pp. 346–350.
7. Danda, A. K. (2010) 'Comparison of a single noncompression miniplate versus 2 noncompression miniplates in the treatment of mandibular angle fractures: a prospective, randomized clinical trial', *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons*, 68(7), pp. 1565–1567.
8. Devi, V. S. and Gnanavel, B. K. (2014) 'Properties of Concrete Manufactured Using Steel Slag', *Procedia Engineering*, 97, pp. 95–104.
9. Eapen, B. V., Baig, M. F. and Avinash, S. (2017) 'An Assessment of the Incidence of Prolonged Postoperative Bleeding After Dental Extraction Among Patients on Uninterrupted Low Dose Aspirin Therapy and to Evaluate the Need to Stop Such Medication Prior to Dental Extractions', *Journal of maxillofacial and oral surgery*, 16(1), pp. 48–52.
10. Ezoddini, F., Mohammadi, Z. and Tabrizzadeh, M. (2008) 'Root Canal Morphology of Human Mandibular Incisors in Yazd Province', *Dental research journal*, 3(1). Available at: <http://drj.mui.ac.ir/index.php/drj/article/view/32> (Accessed: 11 June 2020).
11. Gopalakannan, S., Senthilvelan, T. and Ranganathan, S. (2012) 'Modeling and Optimization of EDM Process Parameters on Machining of Al 7075-B4C MMC Using RSM', *Procedia Engineering*, 38, pp. 685–690.

12. Govindaraju, L., Neelakantan, P. and Gutmann, J. L. (2017) 'Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements', *Clinical oral investigations*, 21(2), pp. 567–571.
13. Hussainy, S. N. et al. (2018) 'Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up', *Journal of conservative dentistry: JCD*, 21(5), pp. 510–515.
14. Janani, K., Palanivelu, A. and Sandhya, R. (2020) 'Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality - An in vivo study', *Brazilian Dental Science*. doi: 10.14295/bds.2020.v23i1.1805.
15. Jeevanandan, G. and Govindaraju, L. (2018) 'Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial', *European Archives of Paediatric Dentistry*, pp. 273–278. doi: 10.1007/s40368-018-0356-6.
16. Jose, J., P., A. and Subbaiyan, H. (2020) 'Different Treatment Modalities followed by Dental Practitioners for Ellis Class 2 Fracture – A Questionnaire-based Survey', *The Open Dentistry Journal*, pp. 59–65. doi: 10.2174/1874210602014010059.
17. Kavitha, M. et al. (2014) 'Solution combustion synthesis and characterization of strontium substituted hydroxyapatite nanocrystals', *Powder Technology*, 253, pp. 129–137.
18. Kumar, D. and Delphine Priscilla Antony, S. (2018) 'Calcified Canal and Negotiation-A Review', *Research Journal of Pharmacy and Technology*, p. 3727. doi: 10.5958/0974-360x.2018.00683.2.
19. Lekha, L. et al. (2014a) 'Schiff base complexes of rare earth metal ions: Synthesis, characterization and catalytic activity for the oxidation of aniline and substituted anilines', *Journal of organometallic chemistry*, 753, pp. 72–80.
20. Lekha, L. et al. (2014b) 'Synthesis, spectroscopic characterization and antibacterial studies of lanthanide(III) Schiff base complexes containing N, O donor atoms', *Journal of Molecular Structure*, pp. 307–313. doi: 10.1016/j.molstruc.2013.10.014.
21. Liu, J. et al. (2014) 'CBCT study of root and canal morphology of permanent mandibular incisors in a Chinese population', *Acta odontologica Scandinavica*, 72(1), pp. 26–30.
22. Manohar, M. P. and Sharma, S. (2018) 'A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 29(6), pp. 716–720.
23. Menon, S. et al. (2018) 'Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism', *Colloids and surfaces. B, Biointerfaces*, 170, pp. 280–292.
24. Nasim, I. and Nandakumar, M. (2018) 'Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis', *Journal of Conservative Dentistry*, p. 516. doi: 10.4103/jcd.jcd_110_18.
25. Neelakantan, P. et al. (2015) 'Antibiofilm activity of three irrigation protocols activated by ultrasonic, diode laser or Er:YAG laser in vitro', *International endodontic journal*, 48(6), pp. 602–610.
26. Neelakantan, P. et al. (2015) 'Influence of Irrigation Sequence on the Adhesion of Root Canal Sealers to Dentin: A Fourier Transform Infrared Spectroscopy and Push-out Bond Strength Analysis', *Journal of endodontia*, 41(7), pp. 1108–1111.
27. Neelakantan, P., Grotra, D. and Sharma, S. (2013) 'Retreatability of 2 mineral trioxide aggregate-based root canal sealers: a cone-beam computed tomography analysis', *Journal of endodontia*, 39(7), pp. 893–896.
28. Okumura, T. (1927) 'Anatomy of the Root Canals *', *Journal of the American Dental Association*, 14(4), pp. 632–636.
29. Parthasarathy, M. et al. (2016) 'Effect of hydrogen on ethanol-biodiesel blend on performance and emission characteristics of a direct injection diesel engine', *Ecotoxicology and environmental safety*, 134(Pt 2), pp. 433–439.
30. Patil, S. B. et al. (2017) 'Comparison of Extended Nasolabial Flap Versus Buccal Fat Pad Graft in the Surgical Management of Oral Submucous Fibrosis: A Prospective Pilot Study', *Journal of maxillofacial and oral surgery*, 16(3), pp. 312–321.
31. PradeepKumar, A. R. et al. (2016) 'Diagnosis of Vertical Root Fractures in Restored Endodontically Treated Teeth: A Time-dependent Retrospective Cohort Study', *Journal of endodontia*, 42(8), pp. 1175–1180.
32. Praveen, K. et al. (2001) 'Hypotensive anaesthesia and blood loss in orthognathic surgery: a clinical study', *The British journal of oral & maxillofacial surgery*, 39(2), pp. 138–140.
33. Putchala, M. C. et al. (2013) 'Ascorbic acid and its pro-oxidant activity as a therapy for tumours of oral cavity – A systematic review', *Archives of Oral Biology*, pp. 563–574. doi: 10.1016/j.archoralbio.2013.01.016.
34. Rahimi, S. et al. (2008) 'Root canal configuration and the prevalence of C-shaped canals in mandibular second molars in an Iranian population', *Journal of oral science*, 50(1), pp. 9–13.

35. Rahimi, S. and Ghasemi, N. (2013) 'Maxillary First Molar with Two Root Canals = الرحي الأولي للفك العلوي "ثنائية قنوات الجذور"', Sultan Qaboos University Medical Journal, pp. 346–349. doi: 10.12816/0003251.
36. Rajendran, R. et al. (2019) 'Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study', Pesquisa Brasileira em Odontopediatria e Clínica Integrada, pp. 1–10. doi: 10.4034/pboci.2019.191.61.
37. Ramamoorthi, S., Nivedhitha, M. S. and Divyanand, M. J. (2015) 'Comparative evaluation of postoperative pain after using endodontic needle and EndoActivator during root canal irrigation: A randomised controlled trial', Australian endodontic journal: the journal of the Australian Society of Endodontology Inc, 41(2), pp. 78–87.
38. Ravinthar, K. and Jayalakshmi (2018) 'Recent Advancements in Laminates and Veneers in Dentistry', Research Journal of Pharmacy and Technology, p. 785. doi: 10.5958/0974-360x.2018.00148.8.
39. R, R., Rajakeerthi, R. and Ms, N. (2019) 'Natural Product as the Storage medium for an avulsed tooth – A Systematic Review', Cumhuriyet Dental Journal, pp. 249–256. doi: 10.7126/cumudj.525182.
40. Sajan, D. et al. (2011) 'Molecular structure and vibrational spectra of 2,6-bis(benzylidene)cyclohexanone: a density functional theoretical study', Spectrochimica acta. Part A, Molecular and biomolecular spectroscopy, 78(1), pp. 113–121.
41. Siddique, R. and Jayalakshmi, S. (2019) 'Assessment of Precipitate Formation on Interaction of Chlorhexidine with Sodium Hypochlorite, Neem, Aloe vera and Garlic: An in vitro Study', Indian Journal of Public Health Research & Development, p. 3648. doi: 10.5958/0976-5506.2019.04155.x.
42. Siqueira, J. F., Jr and Rôças, I. N. (2008) 'Clinical implications and microbiology of bacterial persistence after treatment procedures', Journal of endodontia, 34(11), pp. 1291–1301.e3.
43. Teja, K. V. and Ramesh, S. (2019) 'Shape optimal and clean more', Saudi Endodontic Journal, 9(3), p. 235.
44. Teja, K. V., Ramesh, S. and Priya, V. (2018) 'Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study', Journal of conservative dentistry: JCD, 21(6), pp. 592–596.
45. Uthrakumar, R. et al. (2010) 'Bulk crystal growth and characterization of non-linear optical bishthiourea zinc chloride single crystal by unidirectional growth method', Current applied physics: the official journal of the Korean Physical Society, 10(2), pp. 548–552.
46. Vertucci, F. J. (2005) 'Root canal morphology and its relationship to endodontic procedures', Endodontic topics. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1601-1546.2005.00129.x>.
47. Vijayakumar, G. N. S. et al. (2010) 'Synthesis of electrospun ZnO/CuO nanocomposite fibers and their dielectric and non-linear optic studies', Journal of alloys and compounds, 507(1), pp. 225–229.
48. Vishnu Prasad, S. et al. (2018) 'Report on oral health status and treatment needs of 5-15 years old children with sensory deficits in Chennai, India', Special care in dentistry: official publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry, 38(1), pp. 58–59.
49. Wahab, P. U. A. et al. (2018) 'Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study', Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons, 76(6), pp. 1160–1164.
50. Website (no date). Available at: Noor SSSE, S Syed Shihaab, Pradeep. Chlorhexidine: Its properties and effects [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1755. Available from: <http://dx.doi.org/10.5958/0974-360x.2016.00353.x> (Accessed: 22 June 2020).
51. Yew, S. C. and Chan, K. (1993) 'A retrospective study of endodontically treated mandibular first molars in a Chinese population', Journal of endodontia, 19(9), pp. 471–473.

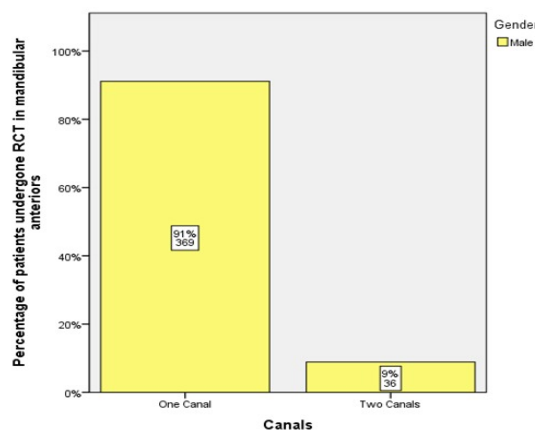


Fig.1 : Bar chart shows the presence of additional canals in female patients. X-axis represents the number of canals in mandibular anteriors among female patients and Y-axis represents the total number of patients who had undergone root canal treatment in mandibular anteriors. The number of additional canals in mandibular anteriors is 7% (24) in females.

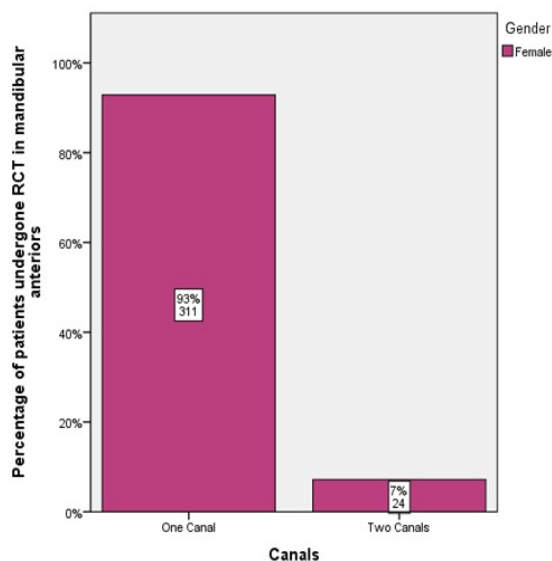


Fig.2 : Bar chart shows the presence of additional canals in male patients. X-axis represents the number of canals in mandibular anteriors among male patients and Y-axis represents the total number of patients who had undergone root canal treatment in mandibular anteriors. The number of additional canals in mandibular anteriors is 9% (36) in males.

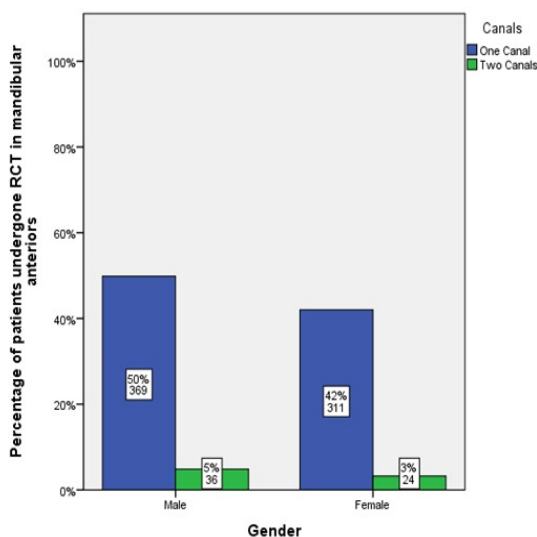


Fig.3: Bar graph depicts the occurrence of additional canals in mandibular anterior teeth based on gender distribution. The X-axis represents gender distribution, Y-axis represents percentage of patients who have undergone root canal treatment in mandibular anteriors. Chi-Square test shows $p=0.121$ ($p>0.05$ -statistically not significant). There is no relation between the gender and presence of additional canals. However, the majority of the patients with additional canals were males.