

DENTINO
JURNAL KEDOKTERAN GIGI
VOL XI. No 2. SEPTEMBER 2026

**RADIOGRAPHIC DENTAL TREATMENT PATTERNS ON PANORAMIC
 RADIOGRAPHS AS SUPPORTIVE MARKERS FOR FORENSIC HUMAN
 IDENTIFICATION**

**Yessy Andriani Fauziah¹⁾, Eveline Yulia Darmadi¹⁾, Dwi Setianingtyas²⁾, Emy Khoironi³⁾, Fuad Al-Sabri⁴⁾,
 Farouk Al-Ghazaly⁵⁾, Cindy Hendrawan⁶⁾, Wahyuni Dyah Parmasari⁷⁾**

¹⁾School of Dental Medicine, Universitas Ciputra, Surabaya-Indonesia

²⁾Department of Oral Medicine, Faculty of Dentistry, Universitas Hang Tuah, Surabaya-Indonesia

³⁾Department of Dental Radiology, Faculty of Dentistry, Universitas Hang Tuah, Surabaya-Indonesia

⁴⁾Department of Conservative Dentistry, Faculty of Dentistry, Thamar University, Dhamar-Yemen

⁵⁾Department of Dentistry, Faculty of Health Science, Aljazeera University, Ibb-Yemen

⁶⁾Dental Medicine Study Program, Faculty of Medicine, Universitas Negeri Surabaya

⁷⁾Department of Medicolegal and Forensic Bioethics, Faculty of Medicine, Wijaya Kusuma University,
 Surabaya-Indonesia

ABSTRACT

Background: Panoramic radiographs provide comprehensive visualization of dental structures and treatment findings that may support forensic human identification through antemortem and postmortem comparisons.

Purpose: This study aimed to evaluate radiographic dental treatment patterns on panoramic radiographs and their potential role as supportive markers for forensic human identification. **Methods:** This retrospective observational study evaluated 100 digital panoramic radiographs of subjects aged 21–40 years obtained from a dental radiology database. Radiographic variables including missing teeth, dental caries, dental restorations, impacted teeth, endodontic treatment, residual roots, and periapical lesions were assessed using standardized radiographic interpretation procedures. Descriptive statistics and Chi-square analysis were performed to evaluate associations between radiographic dental treatment patterns, age group, and sex. **Results:** Impacted teeth represented the most frequent radiographic finding (84.0%), followed by missing teeth (60.0%) and dental caries (52.0%). Significant associations were identified between age group and dental caries ($p=0.048$), dental restorations ($p=0.036$), and impacted teeth ($p=0.006$). Subjects aged 31–40 years demonstrated higher frequencies of dental caries and dental restorations, whereas impacted teeth were more prevalent among subjects aged 21–30 years. No statistically significant association was identified between sex and radiographic dental treatment patterns ($p>0.05$). Frequency combination analysis demonstrated considerable variation in radiographic dental treatment combinations among individuals. **Conclusion:** Panoramic radiographic dental treatment patterns may provide supportive forensic information in human identification because combinations of radiographic findings and previous dental treatment history may demonstrate considerable individual variation.

Keywords: Dental treatment patterns; Forensic odontology; Forensic radiology; Human identification; Panoramic radiography

Correspondence: Yessy Andriani Fauziah, School of Dental Medicine, Universitas Ciputra Surabaya, CitraLand CBD Boulevard, Made, Kec. Sambikerep Surabaya, Jawa Timur 60219, yessy.andriani@ciputra.ac.id

INTRODUCTION

Human identification plays an important role in forensic investigations, particularly in cases involving mass disasters, decomposed remains, criminal investigations, and unidentified bodies. Accurate identification is necessary for humanitarian, legal, and social purposes because it assists in determining the identity of victims and supports judicial processes.¹ Dental identification remains one of the most reliable methods in forensic science because teeth and surrounding oral structures demonstrate high resistance to decomposition, trauma, and extreme environmental conditions compared to soft tissues. Dental radiographs are frequently used for antemortem and postmortem comparison because they provide detailed information regarding anatomical structures, pathological conditions, and previous dental treatment history.^{2,3}

Panoramic radiography is widely used in dental practice because it enables simultaneous visualization of the maxillary and mandibular structures in a single radiographic image.^{4,5} Digital panoramic radiographs provide several advantages in forensic analysis due to their accessibility, image storage capability, and retrospective evaluation potential. In addition to anatomical structures, panoramic radiographs also record cumulative dental treatment history throughout an individual's lifetime.^{6,7} Various radiographic findings such as missing teeth, dental caries, restorations, impacted teeth, root canal treatment, and periapical lesions may create individualized radiographic characteristics among different individuals.⁸ These dental treatment patterns may function as supportive biological markers in forensic identification because combinations of dental conditions and treatment history are rarely identical between individuals. Therefore, panoramic radiography has become an important tool in forensic human identification and disaster victim identification procedures.⁹

Radiographic dental treatment patterns may reflect cumulative oral health conditions and previous dental interventions throughout an individual's life.¹ Dental restorations, root canal treatment, and extraction patterns can produce distinct radiographic appearances that contribute to individualized dental signatures.⁵ These characteristics may assist forensic experts in comparing antemortem and postmortem records for identification purposes.¹⁰ Digital radiographic databases have increased the feasibility of retrospective forensic investigations using panoramic imaging.^{5,11} Variations in the morphology, location, and distribution of dental treatment findings may contribute to radiographic individuality useful for forensic comparison procedures.⁸

In addition, digital radiographic databases have increased the feasibility of retrospective forensic investigations and enhanced the application of panoramic radiographs as supportive forensic evidence in human identification.^{6,12} Most previous panoramic radiographic studies in forensic odontology have focused on age estimation, sex estimation, and craniofacial morphometric analysis. Limited studies have evaluated combined radiographic dental treatment findings as supportive forensic markers, particularly in Southeast Asian or Indonesian populations. Furthermore, the forensic significance of combined panoramic radiographic findings involving missing teeth, restorations, impacted teeth, and periapical lesions remains insufficiently explored. Evaluation of these combined radiographic findings may provide additional forensic information regarding individual variation and radiographic uniqueness. Therefore, this study aimed to evaluate radiographic dental treatment patterns on panoramic radiographs and their potential role as supportive markers for forensic human identification.

MATERIALS AND METHODS

Materials

This retrospective observational study used digital panoramic radiographs obtained from a dental radiology database in Surabaya, Indonesia. A total of 100 panoramic radiographs from subjects aged 21–40 years were included in this study. The radiographs were collected from January to December 2024 using purposive sampling based on predefined inclusion and exclusion criteria. Inclusion criteria consisted of good radiographic quality, clear visualization of maxillary and mandibular anatomical structures, and complete visibility of radiographic dental treatment findings. Radiographs with severe distortion, positioning errors, extensive artifacts, unclear anatomical structures, or incomplete imaging records were excluded from the study.

The evaluated radiographic variables included missing teeth, dental caries, dental restorations, impacted teeth, endodontic treatment, residual roots, and periapical lesions. All radiographic evaluations were performed using standardized digital panoramic radiographic interpretation procedures. Ethical approval for this study was obtained from the Ethics Committee of Faculty of Dental Medicine Universitas Airlangga, Surabaya, Indonesia (No. 1022/HRECC.FODM/X2025).

Methods

Radiographic evaluation was performed to assess radiographic dental treatment patterns associated with forensic human identification. All panoramic radiographs were independently analyzed by two calibrated observers with experience in dental radiographic interpretation. Observer calibration was performed prior to data collection to minimize interpretation bias and improve consistency of radiographic evaluation. The presence or absence of missing teeth, dental caries, restorations, impacted teeth, endodontic treatment, residual roots, and periapical lesions was recorded for each radiograph. Subjects were categorized into two age groups consisting of 21–30 years and 31–40 years. Statistical analysis was performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to determine the frequency, percentage, mean, and standard deviation of radiographic findings. Chi-square analysis was performed to evaluate the association between radiographic dental treatment patterns, age group, and sex. Statistical significance was determined at $p < 0.05$.

Steps of Procedure

All panoramic radiographs were anonymized before evaluation to maintain subject confidentiality and comply with ethical standards. Each radiograph was systematically assessed to identify radiographic findings including missing teeth, dental caries, dental restorations, impacted teeth, endodontic treatment, residual roots, and periapical lesions. The presence or absence of each variable was recorded for every subject using a standardized data collection form.

Subjects were subsequently categorized according to age group and sex for statistical analysis. Descriptive statistical analysis was used to determine the distribution of radiographic findings. Chi-square analysis was performed to evaluate associations between radiographic dental treatment patterns, age group, and sex. In addition, frequency combination analysis was conducted to identify common combinations of radiographic dental findings that may contribute to individualized radiographic dental signatures in forensic human identification.

RESULTS

A total of 100 panoramic radiographs were evaluated to assess radiographic dental treatment patterns associated with forensic human identification. Several radiographic findings including missing teeth, dental caries, dental restorations, impacted teeth, endodontic treatment, residual roots, and periapical lesions were identified with varying frequencies among subjects. Descriptive statistical analysis was performed to determine the distribution of radiographic findings, while Chi-square analysis was conducted to evaluate the association between radiographic dental treatment patterns, age group, and sex. In addition, frequency combination analysis was performed to identify common combinations of radiographic dental findings that may contribute to individualized radiographic dental signatures in forensic human identification.

Table 1. Distribution of Radiographic Dental Treatment Patterns

Variable	Frequency (n)	Percentage (%)	Mean $\pm$ SD
Missing Teeth	60	60.0	1.23 $\pm$ 1.56
Dental Restorations	34	34.0	0.81 $\pm$ 1.58
Endodontic Treatment	11	11.0	0.13 $\pm$ 0.39
Impacted Teeth	84	84.0	2.24 $\pm$ 1.41
Residual Roots	21	21.0	0.42 $\pm$ 1.13
Periapical Lesions	25	25.0	0.40 $\pm$ 0.88
Dental Caries	52	52.0	0.98 $\pm$ 1.30

Impacted teeth represented the most frequent radiographic finding (84.0%), followed by missing teeth (60.0%) and dental caries (52.0%). Endodontic treatment showed the lowest frequency among the evaluated variables (11.0%). The mean number of impacted teeth was 2.24 ± 1.41 , while missing teeth demonstrated a mean value of 1.23 ± 1.56 .

Table 2. Analysis of Radiographic Dental Treatment Patterns and Age Group

Variables	21–30 Years Present n (%)	31–40 Years Present n (%)	Chi-square Value	p-value	Interpretation
Missing Teeth	39 (54.2%)	21 (75.0%)	2.829	0.093	Not significant
Dental Caries	33 (45.8%)	19 (67.9%)	3.900	0.048	Significant
Dental Restorations	20 (27.8%)	14 (50.0%)	4.397	0.036	Significant
Impacted Teeth	65 (90.3%)	19 (67.9%)	7.690	0.006	Significant

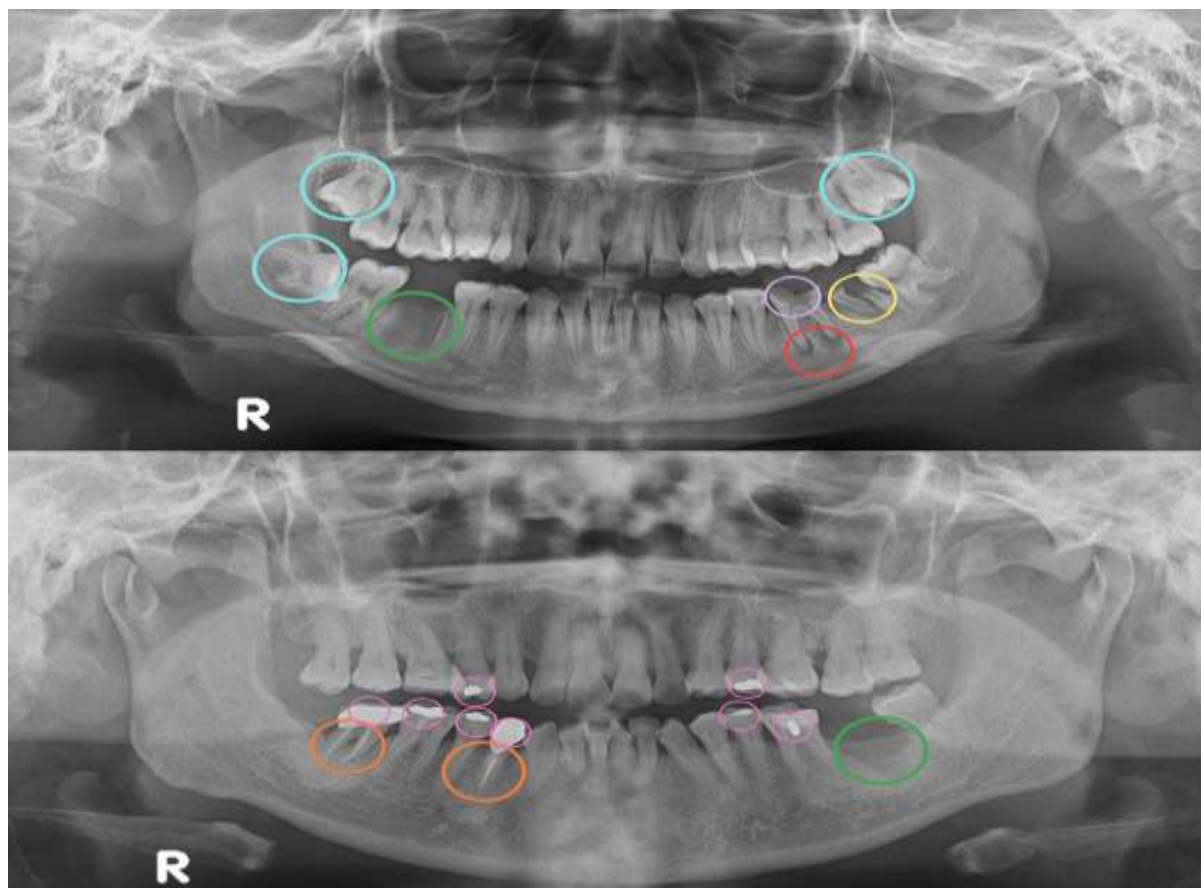


Figure 1. Representative panoramic radiographs demonstrating radiographic dental treatment patterns associated with forensic human identification. Light blue circles indicate impacted teeth, pink circles indicate dental restorations, yellow circles indicate residual roots, green circles indicate missing teeth, purple circles indicate dental caries, red circles indicate periapical lesions, and orange circles indicate endodontic treatment findings.

Chi-square analysis demonstrated no statistically significant association between age group and missing teeth ($p=0.093$). However, subjects aged 31–40 years demonstrated a higher proportion of missing teeth (75.0%) compared to subjects aged 21–30 years (54.2%). Chi-square analysis demonstrated a statistically significant association between age group and dental caries ($p=0.048$). Subjects aged 31–40 years demonstrated a higher prevalence of dental caries (67.9%) compared to subjects aged 21–30 years (45.8%). Chi-square analysis demonstrated a statistically significant association between age group and dental restorations ($p=0.036$). Subjects aged 31–40 years demonstrated a higher prevalence of dental restorations (50.0%) compared to subjects aged 21–30 years (27.8%). Chi-square analysis demonstrated a statistically significant association between age group and impacted teeth ($p=0.006$). Subjects aged 21–30 years demonstrated a higher prevalence of impacted teeth (90.3%) compared to subjects aged 31–40 years (67.9%).

Table 3. Analysis of Radiographic Dental Treatment Patterns and Sex

Variables	Male Present n (%)	Female Present n (%)	Chi-square Value	p-value	Interpretation
Missing Teeth	28 (56.0%)	32 (64.0%)	0.375	0.540	Not significant
Dental Caries	22 (44.0%)	30 (60.0%)	2.571	0.109	Not significant
Dental Restorations	12 (24.0%)	22 (44.0%)	3.610	0.057	Not significant
Impacted Teeth	44 (88.0%)	40 (80.0%)	1.176	0.278	Not significant

Chi-square analysis demonstrated no statistically significant association between sex and missing teeth ($p=0.540$), dental caries ($p=0.109$), dental restorations ($p=0.057$), or impacted teeth ($p=0.278$). Female subjects

demonstrated a higher prevalence of dental caries and dental restorations compared to male subjects, although these associations were not statistically significant.

Table 4. Most Frequent Combination Patterns

No	Combination Pattern	Frequency (n)	Percentage (%)
1	Impacted teeth only	15	15.0
2	Missing teeth + impacted teeth	14	14.0
3	Impacted teeth + dental caries	10	10.0
4	Missing teeth + impacted teeth + dental caries	6	6.0
5	Missing teeth + restorations + impacted teeth	6	6.0
6	Missing teeth + impacted teeth + residual roots + periapical lesions + dental caries	5	5.0
7	Impacted teeth + periapical lesions + dental caries	3	3.0
8	Missing teeth only	3	3.0
9	Missing teeth + restorations + endodontic treatment + impacted teeth + dental caries	3	3.0
10	Missing teeth + restorations + impacted teeth + dental caries	3	3.0

Frequency combination analysis demonstrated considerable variation in radiographic dental treatment patterns among subjects. The most frequent pattern was impacted teeth only (15.0%), followed by the combination of missing teeth and impacted teeth (14.0%). Several subjects demonstrated complex combinations involving restorations, endodontic treatment, residual roots, periapical lesions, and dental caries. These findings suggest that panoramic radiographic dental patterns may provide individualized characteristics that support forensic human identification.

DISCUSSION

This study demonstrated that impacted teeth represented the most frequent radiographic finding identified on panoramic radiographs, followed by missing teeth and dental caries. These findings suggest that panoramic radiographs may reflect cumulative oral health conditions and previous dental interventions that contribute to individualized radiographic dental signatures useful for forensic human identification.^{5,10} The high prevalence of impacted teeth observed in this study may be associated with eruption disturbances, limited arch space, and delayed extraction of third molars, which are commonly detected on panoramic radiographs and may contribute to radiographic individuality in forensic identification.¹³ Previous studies reported that impacted teeth and anatomical variations identified on panoramic imaging may provide valuable forensic information because radiographic dental morphology and tooth position differ among individuals.^{14,15} These radiographic findings may therefore support antemortem and postmortem comparison procedures in forensic investigations.¹

Significant associations were identified between age group and the prevalence of dental caries, dental restorations, and impacted teeth. Individuals aged 31–40 years demonstrated higher frequencies of dental caries and restorative treatment findings compared to subjects aged 21–30 years. These findings may reflect cumulative oral disease progression and greater lifetime exposure to restorative dental treatment with increasing age.^{16,17} Dental restorations possess important forensic value because the morphology, distribution, and radiographic appearance of restorative materials may produce distinctive characteristics that remain relatively stable over time.^{8,18} Previous studies have reported that restorative treatment history and radiographic dental findings may support antemortem and postmortem comparison during forensic human identification procedures.¹ Conversely, impacted teeth were more frequently identified among younger adults, possibly due to incomplete eruption or delayed extraction of third molars.^{19,20}

No statistically significant association was identified between sex and radiographic dental treatment patterns in the present study. These findings suggest that treatment-related radiographic characteristics may be more strongly influenced by oral health history and treatment exposure than by biological sex.^{9,21} However, female subjects demonstrated slightly higher frequencies of dental caries and dental restorations compared to male subjects. These findings may be influenced by differences in oral health behavior, aesthetic awareness, hormonal factors, and dental treatment utilization between sexes.²² Previous studies similarly reported that sex differences in dental treatment prevalence are often inconsistent and may vary according to population

characteristics, socioeconomic status, oral hygiene behaviour, and access to dental care.^{23,24} Therefore, radiographic dental treatment patterns may possess greater forensic value as individualized characteristics rather than as sex-specific indicators. In forensic human identification, the uniqueness of combined dental findings is generally considered more important than isolated demographic associations.⁵

Frequency combination analysis demonstrated substantial variation in radiographic dental treatment combinations among subjects. The most frequent combination pattern observed in this study was impacted teeth only, followed by the combination of missing teeth and impacted teeth. Several subjects demonstrated more complex combinations involving restorations, endodontic treatment, residual roots, periapical lesions, and dental caries. These findings support the concept that panoramic radiographs may produce individualized radiographic dental signatures because combinations of dental conditions and treatment history are rarely identical among individuals.⁹ Previous forensic studies emphasized that the combination of anatomical characteristics, pathological findings, and restorative treatment patterns may increase the accuracy of antemortem and postmortem dental comparison.^{1,5} Digital panoramic radiography additionally provides advantages for retrospective forensic investigations because radiographic records can be stored, retrieved, and compared efficiently using digital databases.⁵

The increasing application of artificial intelligence in digital panoramic radiography may improve the efficiency, accuracy, and standardization of forensic human identification through automated radiographic analysis.^{5,6} However, ethical considerations regarding data privacy, informed consent, algorithm transparency, and responsible use of artificial intelligence remain important issues that must be carefully addressed in forensic dental practice.²⁵ This study has several limitations. The study population was limited to subjects aged 21–40 years and used a relatively limited sample size from a single radiographic database. In addition, this study evaluated only selected radiographic dental treatment variables without assessing detailed restorative morphology or advanced radiographic characteristics. Observer interpretation bias may still occur despite the use of standardized radiographic evaluation procedures and calibrated observers. Future studies involving larger multicentre populations and artificial intelligence-assisted radiographic analysis may provide more comprehensive forensic evaluation of individualized dental signatures. Nevertheless, the present study demonstrated that panoramic radiographic dental treatment patterns may provide supportive individualized forensic markers that contribute to forensic human identification.

CONCLUSION

Panoramic radiographic dental treatment patterns demonstrated potential as supportive individualized forensic markers in human identification. Combinations of radiographic findings such as impacted teeth, missing teeth, dental caries, and dental restorations may contribute to individualized radiographic dental signatures that support antemortem and postmortem comparison procedures in forensic investigations.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Pramita Laboratory Surabaya for their support and assistance in facilitating this research. The authors also gratefully acknowledge the Institute for Research and Community Service (LPPM) of Universitas Ciputra Surabaya for providing internal research funding that supported this study.

REFERENCES

1. Bianchi I, Focardi M, Grifoni R, Rizzo A, Defraia B, Pinchi V. Dental Identification of Unknown Bodies Through antemortem data taken by Non-Dental X-rays Case reports. *Journal of Forensic Odonto-Stomatology*. Published online 2021.
2. Kim J, Evans N, Jiang H, Milne N, Soon A. Utilisation of non-dental radiographs in forensic dental identification of unknown human remains: a Queensland case series. *J Forensic Odontostomatol*. 2025;43(3). doi:10.5281/zenodo.17776370
3. Matsuda S, Yoshida H, Ebata K, Shimada I, Yoshimura H. Forensic odontology with digital technologies: A systematic review. *J Forensic Leg Med*. 2020;74:102004. doi:10.1016/J.JFLM.2020.102004
4. Ortiz AG, Soares GH, da Rosa GC, Biazevic MGH, Michel-Crosato E. A Pilot Study of an Automated Personal Identification Process: Applying Machine Learning to Panoramic Radiographs. *Imaging Sci Dent*. 2021;51:1-7. doi:10.5624/isd.20200324

5. Radu CC, Hoge T, Carașca C, Radu CM. Forensic Odontology in the Digital Era: A Narrative Review of Current Methods and Emerging Trends. *Diagnostics*. 2025;15(20):2550. doi:10.3390/diagnostics15202550
6. Fauziah YA, Darmadi EY, Tjandra RR. Integrating Digital Imaging and AI in Forensic Odontology: Enhancing Identification Accuracy and Efficiency. *RSF Conference Series: Business, Management and Social Sciences*. 2024;4(1):213-219. doi:10.31098/bmss.v4i1.882
7. Kamburoğlu K. Role of dentomaxillofacial radiology in forensic dentistry. *World J Radiol*. 2026;18(1). doi:10.4329/wjr.v18.i1.114957
8. Fauziah YA, Darmadi EY, Budiharjo A, Wahjuningrum DA. Forensic Identification Using Dental Restorations: A Radiographic and Material-Based Perspective. *Conservative Dentistry Journal*. 2025;15(1). doi:10.20473/cdj.v15i1.2025.1-4
9. Choi HR, Siadari TS, Kim JE, et al. Automatic detection of teeth and dental treatment patterns on dental panoramic radiographs using deep neural networks. *Forensic Sci Res*. 2022;7(3):456-466. doi:10.1080/20961790.2022.2034714
10. Kim YH, Ha EG, Jeon KJ, Lee C, Han SS. A fully automated method of human identification based on dental panoramic radiographs using a convolutional neural network. *Dentomaxillofacial Radiology*. 2022;51(4). doi:10.1259/dmfr.20210383
11. Fauziah YA, Bagus Narmada I, Darmadi EY, et al. Integration of Advanced Technology in Forensic Odontology: Revolutionizing Identification and Forensic Analysis. *Research J Pharmacy and Technology*. 2025;18(7):3250-3257. doi:10.52711/0974-360X.2025.00468
12. Esfehiani M, Ghasemi M, Katiraei A, et al. Forensic Gender Determination by Using Mandibular Morphometric Indices an Iranian Population: A Panoramic Radiographic Cross-Sectional Study. *J Imaging*. 2023;9(2). doi:10.3390/jimaging9020040
13. Shumar A. Prevalence of impacted third molars and its associated pathologies among population in Sanaa city – Yemen. *International Arab Journal of Dentistry*. 2020;11(2). doi:10.65314/2218-0885.1169
14. Naraynsingh CN, Henry K, Hunte R, Ramlogan N, Bissoon A. Prevalence and Pattern of Tooth Impaction: A Radiographic Study in a Trinidadian Population. *Niger J Clin Pract*. 2024;27(7):837-843. doi:10.4103/njcp.njcp_779_23
15. Girijan P, Boedi R, Mânica S, Franco A. The radiographic diversity of dental patterns for human identification — Systematic review and meta-analysis. *J Forensic Leg Med*. 2023;95. doi:10.1016/j.jflm.2023.102507
16. Al Subaie A, Alruwili R, Alkhuadher B, Alzawwad S, Alzamil W, Al-Khalifa KS. Assessing the Management and Evaluation of Impacted Wisdom Teeth in a Dental Teaching Hospital. *Dent J (Basel)*. 2025;13(2). doi:10.3390/dj13020069
17. Santos MJMC, Zare E, McDermott P, Santos Junior GC. Multifactorial Contributors to the Longevity of Dental Restorations: An Integrated Review of Related Factors. *Dent J (Basel)*. 2024;12(9). doi:10.3390/dj12090291
18. Alamoudi RA. The Role of an Endodontist in Victim Identification: A Narrative Review on Forensic Endodontics. *Cureus*. Published online 2024. doi:10.7759/cureus.53391
19. Rauf S, Ali W, Tariq Q, Chaudhry R, Kazmi SS, Imtiaz M. Pattern of mandibular third molar impaction: a radiographic study. *Pakistan Oral & Dental Journal*. 2019;39(3).
20. Adetolu A, Ibukun U, Olayinka E, Ikponmwosa E, Samson A, Ojombo A. Prevalence and pattern of mandibular third molar impaction: A 4-year retrospective study of cases seen at a tertiary hospital in Nigeria. *Majmaah Journal of Health Sciences*. 2026;14(1). doi:10.5455/mjhs.2026.01.012
21. Salam S, Bary A, Sayed A. Prevalence of impacted teeth and pattern of third molar impaction among Kerala population a cross sectional study. *J Pharm Bioallied Sci*. 2023;15(5). doi:10.4103/jpbs.jpbs_618_22
22. Lee HJ, Lee HJ. Sex/Gender Differences in Dental Diseases. In: *Sex/Gender-Specific Medicine in Clinical Areas*. 2024. doi:10.1007/978-981-97-0130-8_34
23. Ayyad H, Ghaith H. Oral Hygiene Status and Caries Experiences Among Smoker Male in Associated with Their Knowledge in Benghazi City, Libya. *AlQalam Journal of Medical and Applied Sciences*. Published online March 31, 2025:380-386. doi:10.54361/ajmas.258155
24. Siraj SE, George B, Paul SSN. The Relationship Between Socioeconomic Status and Dental Caries Among Adults in India: A Scoping Review. *Journal of Research and Health*. 2024;14(3). doi:10.32598/JRH.14.3.2338.1
25. Fauziah YA, Alhadad H, Utama YP. Etika dan Tantangan Penggunaan Kecerdasan Buatan Dalam Kedokteran Gigi. *Jurnal Hukum dan Etika Kesehatan*. 2024;4(2).