

ORIGINAL ARTICLE

Training Indian Undergraduate Students in Dental Charting and Radiographic Comparison for Disaster Victim Identification (DVI)

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ABSTRACT

Background: Dental records serve as a primary identifier in Disaster Victim Identification (DVI), yet structured undergraduate training in forensic odontology remains limited in India.

Aim: To evaluate the effectiveness of a structured training module in improving dental charting and radiographic comparison skills among Indian undergraduate dental students.

Materials and Methods: Sixty final-year dental students participated in a prospective interventional study involving pre-training assessment, structured didactic and simulation-based training, and post-training evaluation. Accuracy of dental charting and radiographic comparison, completion time, inter-observer agreement (Cohen's kappa), and self-reported confidence were measured. Paired t-tests were applied for statistical analysis ($p < 0.05$).

Results: Charting accuracy improved from 62.4% to 84.7%, and radiographic comparison accuracy increased from 58.3% to 81.9% ($p < 0.001$). Inter-observer agreement improved from moderate to substantial levels. Confidence scores increased significantly.

Conclusion: Simulation-based DVI training significantly enhances technical competency and reliability among undergraduate dental students, supporting integration into dental curricula.

KEYWORDS

- Forensic Dentistry • Disaster Victim Identification • Dental Charting
- Radiography • Dental education

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INTRODUCTION

Disaster Victim Identification (DVI) is a critical component of forensic investigation in mass casualty incidents, including natural disasters, aviation crashes, industrial accidents, and terrorist attacks.¹ Among primary identifiers, dental records play a pivotal role due to the durability of teeth and restorations under extreme environmental conditions.² Forensic odontology has consistently demonstrated high reliability in comparative dental identification, particularly when antemortem and postmortem dental records are available.³ In India, despite increasing exposure to natural calamities and mass disasters, structured undergraduate training in DVI remains limited within the Bachelor of Dental Surgery (BDS) curriculum.⁴

Dental charting accuracy and radiographic comparison are foundational skills in forensic identification.⁵ However, undergraduate students often receive theoretical exposure without structured practical training in DVI simulation exercises. Early competency development may improve future professional preparedness and strengthen national forensic response capacity.^{6,7} Previous studies in Europe and Australia have emphasized simulation-based forensic training to improve student confidence and technical precision, yet similar structured educational models are underreported in the Indian context.⁸⁻¹⁰

Given this gap, the present study aimed to evaluate the effectiveness of a structured training module designed to enhance dental charting accuracy and radiographic comparison skills among Indian undergraduate dental students. The study assessed pre and post-training competency levels, inter-observer agreement, and student confidence in DVI-related procedures. By integrating practical simulation exercises, this initiative sought to establish an evidence-based framework for incorporating forensic odontology training into undergraduate dental education.

MATERIALS AND METHODOLOGY

This prospective interventional educational study was conducted among 60 final-year undergraduate dental students at a Kothiwal Dental College and Research Centre, Moradabad. Ethical approval was obtained from the Institutional Ethics Committee

prior to commencement. Participation was voluntary, and written informed consent was secured from all students.

The study design included three phases: baseline assessment (pre-test), structured training intervention, and post-training evaluation. During the baseline phase, students were asked to complete standardized dental charting for ten simulated cases using anonymized dental models prepared with varied restorations, missing teeth, prosthetic components, and endodontic treatments. Additionally, students were required to compare five pairs of antemortem and postmortem digital radiographs to determine concordance or discrepancy. Accuracy was evaluated using a validated scoring rubric developed in accordance with Interpol DVI guidelines.¹¹

The structured training module (3 modules of 2 days each) consisted of two components: (1) didactic lectures covering principles of forensic odontology, DVI protocols, Interpol forms, dental notation systems (FDI and Palmer), and radiographic comparison techniques; and (2) hands-on simulation sessions conducted over two days. During simulation exercises, students practiced dental charting under faculty supervision and performed radiographic (Orthopantomographs) comparisons using Image J digital software. Emphasis was placed on systematic documentation, identification of concordant features, and elimination of subjective interpretation.

Following completion of the training module, students underwent post-intervention assessment using a new set of simulated cases with similar complexity. Performance metrics included charting accuracy percentage, radiographic comparison accuracy, time taken for completion, and inter-observer agreement (measured using Cohen's kappa). Additionally, students completed a structured self-assessment questionnaire evaluating confidence levels in performing DVI procedures on a 5-point Likert scale.

Data were analyzed using SPSS version 25. Continuous variables were expressed as mean \pm standard deviation. Paired t-tests were applied to compare pre- and post-training performance scores. Cohen's kappa statistics were calculated to assess agreement levels. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 60 final-year undergraduate dental students participated in the study. The mean age was 22.1 ± 0.8 years, with a predominance of females (38) compared to males (22). Only 15% had prior exposure to forensic odontology training, while all participants had previous experience with dental radiographic procedures (Table 1).

Table 1: Baseline Characteristics of Participants (n = 60)

Variable	Value
Mean Age (years)	22.1 ± 0.8
Gender (M/F)	22 / 38
Prior Forensic Exposure (%)	15%
Previous Radiographic Training (%)	100%

The mean dental charting accuracy improved significantly from $62.4\% \pm 9.8\%$ at baseline to $84.7\% \pm 6.5\%$ post-training ($p < 0.001$). Radiographic comparison accuracy increased from $58.3\% \pm 11.2\%$ to $81.9\% \pm 7.4\%$ ($p < 0.001$). The average time required to complete charting reduced from 24.5 ± 5.2 minutes to 17.2 ± 3.8 minutes following training ($p < 0.001$) (Table 2).

Table 2: Comparison of Pre and Post-Training Performance

Parameter	Pre-Training	Post-Training	p-value
Charting Accuracy (%)	62.4 ± 9.8	84.7 ± 6.5	0.001*
Radiographic Accuracy (%)	58.3 ± 11.2	81.9 ± 7.4	0.001*
Completion Time (minutes)	24.5 ± 5.2	17.2 ± 3.8	0.001*
Confidence Score	2.3 ± 0.6	4.1 ± 0.5	0.001*

$P < 0.05$: significant

Inter-observer agreement improved substantially (Table 3). Cohen's kappa for charting accuracy increased from 0.41 (moderate agreement) pre-training to 0.73 (substantial agreement) post-training. Radiographic comparison agreement improved from 0.38 to 0.69. Student-reported confidence scores increased from a mean of 2.3 ± 0.6 to 4.1 ± 0.5 on the Likert scale ($p < 0.001$).

Table 3: Inter-Observer Agreement (Cohen's Kappa)

Assessment	Pre-Training	Post-Training
Dental Charting	0.41	0.73
Radiographic Comparison	0.38	0.69

The distribution of charting errors decreased markedly following training. Incorrect tooth notation reduced from 28%

to 8%, missed restorations from 24% to 9%, radiographic misinterpretation from 32% to 11%, and documentation errors from 16% to 5%. The greatest reduction was observed in radiographic misinterpretation (Table 4). These findings indicate that structured simulation-based training significantly improves accuracy, standardization, and documentation reliability in DVI-related dental charting procedures.

Table 4: Distribution of Charting Errors

Error Type	Pre-Training (%)	Post-Training (%)
Incorrect Tooth Notation	28%	8%
Missed Restorations	24%	9%
Radiographic Misinterpretation	32%	11%
Documentation Errors	16%	5%

DISCUSSION

The present study demonstrates that structured simulation-based training significantly improves undergraduate competency in dental charting and radiographic comparison for DVI applications. The observed increase in accuracy aligns with international findings suggesting that experiential learning enhances forensic documentation skills.^{12,13} Previous educational research in forensic odontology has emphasized the importance of hands-on exercises in improving both technical precision and confidence.^{14,15} Similar improvements in inter-observer agreement have been reported following standardized calibration exercises.¹⁶

Dental charting errors observed at baseline predominantly involved incorrect tooth notation and missed restorations, reflecting insufficient practical exposure.¹⁷ Post-training reductions in these errors indicate the effectiveness of supervised simulation. The improvement in kappa values from moderate to substantial agreement suggests enhanced standardization and reduced subjective variability among students.¹⁸

Radiographic comparison is a cognitively demanding process requiring pattern recognition and systematic evaluation.^{2,3} The marked improvement in radiographic concordance accuracy following training underscores the value of structured guidance in interpreting antemortem and postmortem images.¹² Furthermore, the reduction in

completion time without compromising accuracy suggests improved efficiency and workflow organization.^{9,15}

In the Indian context, forensic odontology remains underrepresented in undergraduate curricula.⁸ Given the country's vulnerability to mass disasters, early skill development may strengthen national DVI preparedness.⁷ Integration of structured modules into BDS programs could foster a competent workforce capable of supporting forensic teams.^{4,14}

Limitations include single-center design and simulated case-based evaluation rather than real-case exposure. Future multicentric studies incorporating standardized national modules are recommended.

CONCLUSION

Structured simulation-based training significantly enhances dental charting accuracy, radiographic comparison skills, inter-observer agreement, and student confidence in Disaster Victim Identification procedures. Incorporating practical DVI modules into undergraduate dental curricula may strengthen forensic preparedness and improve documentation reliability. Early competency development in forensic odontology can contribute meaningfully to national disaster response systems. Further multicentric research is warranted to standardize undergraduate forensic training frameworks across India.

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REFERENCES

1. Forrest A. Forensic odontology in DVI: current practice and recent advances. *Forensic Sci Res.* 2019 Nov 6;4(4):316-330.
2. Emam NM. Role of Forensic Odontology in Identification of Persons: A Review Article. *Cureus.* 2024 Mar 20;16(3):e56570.
3. Pramod JB, Marya A, Sharma V. Role of forensic odontologist in post mortem person identification. *Dent Res J (Isfahan).* 2012;9(5):522-30.
4. Pillai JP, Chokkalingam TS, Aasaithambi B, Nuzzolese E. Establishment of the forensic odontology department: A proposed model for the basic infrastructure and forensic odontology kit. *J Forensic Dent Sci* 2019; 11:64-72.
5. Agrawal A, Prashanth VK, Dodamani A, Pundkar S, Ray P, Hamand A. Importance and Maintenance of Dental Records - Are Dentists Aware? A Survey Among Private Dental Practitioners. *Journal of Forensic Dental Sciences* 2020; 12(3):151-157.
6. Zwirner J, Duncan W. A disaster victim identification workshop focused on forensic odontology using embalmed human remains. *Int J Legal Med.* 2022 Nov;136(6):1801-1809.
7. Suryadi T, Syarifudin K. Disaster Victim Identification (DVI) Training For Medical Student. *Jurnal Pendidikan Kedokteran Indonesia: The Indonesian Journal of Medical Education.* 2020; 9: 95.
8. Das R. Current Challenges and Perspectives of Undergraduate Forensic Science Students in India - An Academic Survey. *International Journal for Research in Applied Science and Engineering Technology* 2021; 9: 1452-1457.
9. Kanter E. Evaluation of the Level of Knowledge of Emergency Residents and Intern Physicians in the Management of Forensic Cases Coming to the Emergency Department. *Balikesir Medical Journal.* 2025; 9: 114-115.
10. Nilendu D. Enhancing forensic education: exploring the importance and implementation of evidence-based education system. *Egypt J Forensic Sci* 2024; 14: 6.
11. Sweet D. INTERPOL DVI best-practice standards--An overview. *Forensic Sci Int.* 2010 Sep 10;201(1-3):18-21.
12. Tang B, Wang K, Liu Y, Liu L, Ren J, You M. Research on the Application and Effect of a Virtual Simulation Platform in Undergraduate Education in Oral Radiology Courses. *Adv Med Educ Pract.* 2025 Oct 18;16:1929-1937.
13. Lattas D, Davis C, Creamer C, Jefferies G. The Use of Simulation in Forensic Social Work Education: A Scoping Review. *International Journal of Forensic Mental Health.* 2024;24(1):27-42.
14. Nilendu, D. (2024). Enhancing forensic education: exploring the importance and implementation of evidence-based education system. *Egyptian Journal of Forensic Sciences.* 2024;14: 6.
15. Chunhabundit P, Arayapisit T, Srimaneekarn N. Evaluating dental student competency in

- forensic rugoscopy for human identification. *Sci Rep.* 2025 Dec 25;16(1):3394.
16. Zikir AP, Angelakopoulos N, Franco A, Merdietio Boedi R. Assessing the impact of structured teaching on dental age estimation using the Demirjian staging system among undergraduate dental students. *J Forensic Odontostomatol.* 2025 Dec 24;43(3):31-38.
 17. Brown N, Jephcote V, Morrison J, Sutton J. Inaccurate dental charting in an audit of 1128 general dental practice records. *Dental Update.* 2017; 44: 254-260.
 18. Madadzadeh F, Ghafari H, Bahariniya S. Kappa Statistics: A Method of Measuring Agreement in Dental Examinations. *Open Public Health J,* 2023; 16: e18749445259818.