Accuracy and confidence in human dental identification using panoramic radiographs: the role of observer experience

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ABSTRACT

Swift and accurate disaster victim identification (DVI) is essential for medicolegal closure and repatriation of remains. Dental comparison is one of three primary identification methods recognized by The International Criminal Police Organization (INTERPOL), and is conducted by forensic odontologists, often by matching antemortem and postmortem intraoral radiographs. However, obtaining postmortem intraoral images can sometimes be challenging (e.g., from burn victims) and in those cases extraoral methods, especially computed tomography (CT), could be an alternative. This study uses conventional panoramic radiographs (PRs) to simulate CT-reconstructed PRs which are increasingly used in forensic scenarios, where traditional intraoral postmortem imaging is challenging. The aim is to assess the accuracy in comparative dental identification by different professionals when comparing antemortem intraoral radiographs to postmortem PRs.

In this retrospective study, intraoral radiographs and PRs from 30 patients were used to simulate a closed disaster event with 25 deceased and 30 possible missing persons. Twenty-five observers from four professional groups—eight oral radiology specialists (ORs), three forensic odontologists (FOs), six dentists trained in the basics of DVI (DVI-D), and eight dental students (DS) - matched PRs, serving as simulated postmortem radiographs, to antemortem intraoral radiographs using a comparative method. Statistical analysis was performed using chi-square and Kruskal-Wallis tests.

FOs and ORs achieved 100% accuracy, while DS and DVI-D had accuracy rates of 98.5% and 94.7%, respectively. Fillings were the most commonly used radiographic feature for matching. Confidence levels, ranging from "no match" to "established", differed, with 96% of ORs and 92% of FOs selecting established matches compared with 67% of DS and 51% of DVI-D.

Conventional PRs can be used for accurate matching in dental identification, particularly when interpreted by experienced observers. FOs and ORs had significantly higher matching accuracy and confidence, emphasizing the critical importance of observer experience; these findings support that ORs may be an asset in DVI operations.

INTRODUCTION

Death may occur due to natural causes or unexpected events such as accidents, mass disasters or crimes, which often result in extensive and unpredictable injuries. In all such cases, establishing the identity of the deceased is essential before issuing death certificates. The International Criminal Police Organization (INTERPOL) recognizes three primary identifiers: dental comparison, DNA analysis, and friction ridge analysis such as fingerprints.[1] Compared with the other two, dental structures are both tough and well protected, resisting both decomposition and extreme temperatures.[2–4] This, combined with the uniqueness of each person's teeth, makes them valuable for postmortem (PM) identification.[2,5]

When there are multiple fatalities and when the police deem it necessary, a disaster victim identification (DVI) operation is initiated, and a DVI team, which follows INTERPOL's guidelines, is activated.[1] In many cases, these identifications must be performed hastily to aid criminal investigations and/or provide crucial answers for relatives. [6,7]

The DVI team includes forensic odontologists (FOs).[1] In Sweden, the Swedish National Board of Forensic Medicine (Rättsmedicinalverket) is the sole employer of FOs and currently has three tenured FOs.[8] These FOs acquire their expertise through national and international postgraduate education, continuing professional development courses, and practical training. More than 250 dental identifications are conducted yearly by FOs in Sweden. When a DVI incident occur, the FOs can be supported by an additional nine intermittently employed dentists trained in the basics of DVI (DVI-D). The DVI-D consists of general dental practitioners or dental specialists who have undergone basic DVI training focusing on PM examination methodology and AM data transcription. Together, FOs and DVI-D constitute the core dental personnel for dental identification in Swedish DVI operations.

Oral radiology specialists (ORs), whose specialty requires proficiency in human identification and age assessment [9], represent another group with relevant competence; however, they do not perform identifications or participate in DVI operations. Although forensic odontology is not formally recognized as a dental specialty in Sweden, it is taught to dental students (DS) at all four dental schools, providing general dental practitioners with a very basic understanding of the field.

Regardless of professional background, all those involved in dental identification rely on the same fundamental methods. Intraoral radiography is considered the gold standard for radiological examination because it captures detailed images of tooth and bone morphology (including anatomical outlines e.g., maxillary sinuses) and dental restorations.[10,11] When performed correctly, intraoral radiographs provide high-resolution images that are essential for identification.[12–14] Furthermore, the images can also be captured under challenging conditions at disaster sites, using portable equipment.[15,16] FOs compare PM dental status, including radiographic images, with AM data such as dental records, radiographic images and other dental information linked to the missing person. Using a comparative method analyzing structures and patterns unique to the individual in the AM and PM material, the FOs assess whether the findings correspond to the same person.[5,17]

More advanced imaging techniques, including computed tomography (CT), cone-beam computed tomography (CBCT), and panoramic radiography have become more common both in clinical practice and for identification.[11,18–21] CT/CBCT provides 3D images for detailed assessments, while panoramic radiographs (PRs) offer an overview of the teeth and jaws. CT/CBCT images can also be transformed into PR reconstructions for easier interpretation and comparison with intraoral images. All these techniques can depict the teeth and other unique anatomical structures.[22] PM intraoral radiographs can sometimes be challenging or impossible to obtain (e.g., from burn victims).[4] Extraoral methods can then be preferred, particularly CT/CBCT images reformatted to PRs for easier interpretation.[11,15,21,23] The use of conventional PRs is often not practical due to the need for precise positioning and specialized equipment.[19,24] However, reformatted CT/CBCT images can in some cases be comparable and even provide benefits compared to conventional PRs, such as wisdom teeth staging, and have shown promising results for identification. [19,21,24] On the other hand, reformatted CT/CBCT images also provide their own challenges, particularly with metal artefacts.

In Sweden, CT/CBCT interpretation is part of the required competence for ORs [9], but falls outside the scope for general practitioners and other odontological specialties.

Given the complexity of these advanced imaging modalities, the ability to accurately interpret them may vary between professionals. [21] Previous studies have shown that FOs and ORs achieve greater matching accuracy than general practitioners and other odontological specialists, especially in complex cases e.g., edentulous individuals or those with unrestored dentition.[14,25–27]

The difference in identification accuracy may be more pronounced when using more advanced modalities such as PRs.[25] Previous findings indicate a high degree of variation in identification accuracy between professions when advanced modalities are used.[21] This means that FOs, DVI-D, and other dental professionals who may be recruited for identification work will likely require additional training to utilize these imaging modalities.[21]

Against this background, the aim of this study was to assess the accuracy of comparative human dental identification using conventional PRs serving as PM and intraoral dental radiographs as AM in a simulated medium-scale closed-disaster event (i.e., an incident where the victim pool is limited and presumptive identities are known, such as an aircraft crash with a passenger list). Additionally, we aimed to analyze the extent to which the experience of the observer affects the ability to perform accurate identification, which radiographically detectable identifiers were used to determine identity, and the degree of certainty.

MATERIALS AND METHODS

Ethical considerations

Ethical approval was obtained (Dnr 2023-08010-01), and the Swedish Ethical Review Authority has raised no objections to the research project. Furthermore, a review by the Västerbotten Region was conducted and approved on March 11, 2024.

All radiographs were retrospectively collected from patient records and fully anonymized. No identifiable personal information was accessible to the observers. The data were handled in accordance with the General Data Protection Regulation (GDPR, EU 2016/679) and institutional data protection guidelines. Given the retrospective and anonymized nature of the study, informed consent was waived by the Swedish Ethical Review Authority.

The study complies with the principles outlined in the Declaration of Helsinki[28] and relevant Swedish regulations for research involving human data.

Study design

This study simulated a medium-scale closed-disaster scenario to assess identification accuracy when comparing PM PRs with AM intraoral radiographs across four different professions; FOs, ORs, DVI-D, and DS.

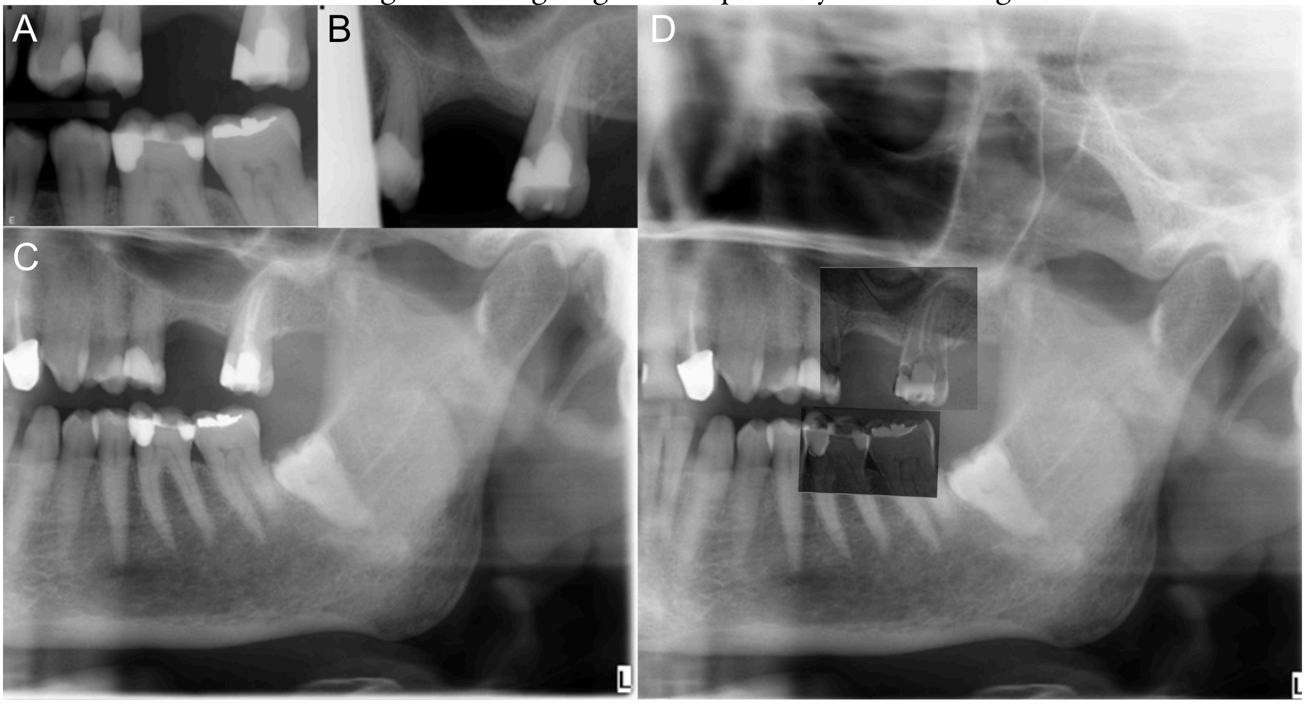
Conventional PRs were used as surrogates for CT-reconstructed PRs, as they provide comparable anatomical overviews and present similar interpretative challenges [23,29], however conventional PRs are more readily available and easier to organize for reading sessions.

Retrospective Collection of Intraoral and Panoramic Radiographs

This study is part of a larger project in which intraoral radiographs and conventional PRs from 100 adult patients were collected from the Oral Diagnostic Radiology Department, Västerbotten Region, during 2023–2024. The examinations were full mouth examinations performed on odontological indications and were included sequentially as they appeared in the image archive. Examinations were excluded if they depicted highly distinguishing features, such as fixation plates or large pathologies, or if no prior examinations were available. All available examinations, including both bite-wings and apical radiographs, from the preceding 10 years were downloaded and anonymized by an oral radiologist (NG). The date of each examination was recorded, and the date of birth and sex were extracted from the social security number.

Once the radiographs were collected, the 100 cases were assessed for inclusion in the present study by two dental students (TT and IL). Thirty-seven patients met the inclusion criteria of having both a PR examination and at least one prior intraoral radiographic examination.

Figure 1. shows representations of antemortem intraoral radiographs (A, B) and a corresponding postmortem panoramic radiograph (C), with superimposed comparison (D) highlighting matching features in teeth 27, 36, and 37, according to FDI World Dental Federation or ISO 3950 notation. In these images the fillings align almost perfectly between images.



Simulated Disaster Scenario

A medium-scale disaster scenario was then simulated by the same dental students, who randomly selected 30 patients from the pool of 37 eligible cases and organized these into presentations (Microsoft PowerPoint). To prevent observers from using the process of elimination, 25 simulated deceased individuals were presented for identification against 30 potential matches in randomized order. The observers were tasked with matching PRs, representing PM material, with intraoral images, representing AM material (Figure 1).

For the 25 simulated deceased individuals, the mean interval between the PR and the most recent intraoral examination was 1.8 years (range: 0.3–6.4 years). The antemortem material consisted of examinations conducted between 2017 and 2024. The average age was 54 years (range: 15–83 years), with 16 males and 14 females.

The prevalence of radiographically detectable identifiers visible on both AM and PM radiographs was 24/25 (96%) for dental fillings, 1/25 (4%) for dental implants, 18/25 (72%) for prosthodontic restorations, and 12/25 (48%) for root canal fillings. In all cases, tooth and bone anatomy were depicted, with no edentulous individuals included. Additionally, 8/25 (32%) exhibited distinctive bone features beyond trabecular anatomy, such as socket sclerosis, extraction socket remnants, or idiopathic sclerosis. Visible tooth anatomy included root morphology, crown morphology, and pulp chamber dimensions, among others.

Observers and Matching

The study included 25 observers: eight ORs, three FOs, six DVI-D, and eight DS. They were also grouped according to experience: eleven with a high degree of experience interpreting complex image data (ORs and FOs) and fourteen with less experience (DVI-D and DS).

The DS were in their final semester and had completed their radiology and forensic odontology training. The DVI-D had 15–30 years of experience as dentists. Further, some have participated in real DVI incidents involving PM examinations and AM data transcription, but none had performed matching during the reconciliation phase. The ORs had practiced solely in radiology for 5–30+ years, and two had experience performing dental identifications. The FOs had 5–20+ years of experience and regularly perform dental identifications.

Observers accessed the material at the Department of Odontology, Umeå University, or at the Swedish National Board of Forensic Medicine. Conditions varied slightly across groups; most used a single screen, while ORs and one FO used multiple screens. DVI-D and two FOs performed their assessments in parallel under identical conditions. All matching was performed individually without discussion. A maximum of 2.5 hours was allotted, which DS and DVI-D nearly fully utilized, whereas ORs and FOs used approximately half of that time. To minimize recall bias, the oral radiologist (NG) performed the matching assessment more than one year after the collection of radiographs, and the dental students who constructed the exercise (TT and IL) were excluded from participation.

Observers were informed that each of the 25 PM cases had a corresponding match among the 30 AM cases, and were permitted to zoom and adjust contrast and brightness. During the assessment, they specified which identifiers supported their match, including dental fillings, tooth morphology, prosthodontics, and bone anatomy. For features such as root fillings or amalgam fragments, the category "other" was used.

Based on the findings, the observers then classified identification outcome according to the INTERPOL DVI scale[1,30]: *identity excluded (no match)*, when PM radiographs were clearly inconsistent with all AM records; *possible identification*, when there were similarities and no excluding features but the available data were limited; *probable identification*, when specific corresponding features were observed despite limited AM or PM material; and *established identification*, when there was absolute certainty that the PM and AM radiographs belonged to the same individual. [1,30]

No formal calibration session was conducted. The observers relied on training inherent to their professions and all received detailed written instructions outlining the assessment procedures.

Statistical Analysis

Power calculations prior to inclusion indicated that with 25 cases at least 3 participants per group were required to detect differences similar to those reported by Fridell and Ahlqvist [26], with 80% power at a significance level of $\alpha = 0.05$, including adjustment for Bonferroni correction.

The data were not normally distributed according to the Shapiro-Wilk and Kolmogorov-Smirnov tests; therefore, group differences were analyzed using cross-tabulations, the chi-square test, and the Kruskal-Wallis test for pairwise comparisons. Bonferroni correction was applied for multiple comparisons, and all reported p-values were adjusted accordingly.

Statistical analyses were performed and charts created using Jamovi project (version 2.6; https://www.jamovi.org), which is based on the R statistical environment (version 4.4).

A p-value of less than 0.05 was considered significant.

RESULTS

Accuracy of matching

Overall, 25 observers from the four different professional groups completed the matching of 25 cases each, resulting in 625 assessments in total. Across all groups 98.2% (614/625) of cases were correctly matched. There were differences between the groups: ORs and FOs were correct in 100% of cases, while DS were correct in 98.5% and DVI-D were correct in 94.7% ($p = 0.013$; Table 1).

When the participants were grouped by level of experience, highly experienced observers (ORs and FOs) demonstrated 100% accuracy, while the less experienced observers (DVI-trained dentists and DS) achieved 96.8% accuracy ($p = 0.012$; Table 2).

Table 1. The count and percentages of correct, no match, and incorrect assessments by oral radiology specialists (ORs), forensic odontologists (FOs), dentists trained in the basics of disaster victim identification (DVI-D), and dental students (DS).

Match	FOs (N=3)	ORs (N=8)	DVI-D (N=6)	DS (N=8)	p-value
Correct (%)	75 (100%)	200 (100%)	142 (94.7%)	197 (98.5%)	0.013
Not found (%)	0 (0%)	0 (0%)	2 (1.3%)	1 (0.5%)	
Incorrect (%)	0 (0%)	0 (0%)	6 (4.0%)	2 (1%)	

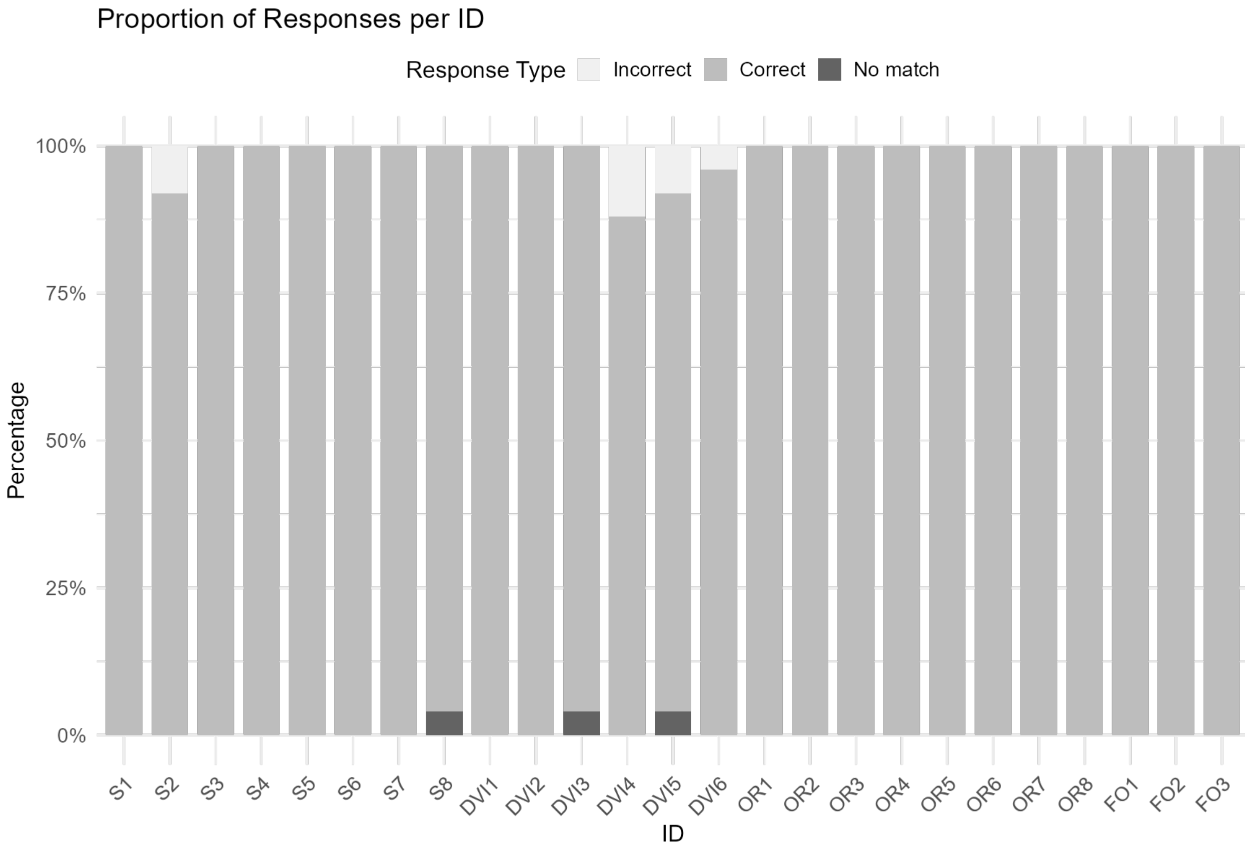
N = number of observers

Table 2. The count and percentages of correct, no match, and incorrect assessments for the highly experienced (oral radiology specialists and forensic odontologists) and less experienced (dentists trained in the basics of disaster victim identification and dental students) observers.

Match	Highly experienced (N=11)	Less experienced (N=14)	p-value
Correct (%)	275 (100%)	339 (96.8%)	0.012
Not found (%)	0 (0%)	3 (0.9%)	
Incorrect (%)	0 (0%)	8 (2.3%)	

N = number of observers

Figure 2. Bar chart visualization showing the percentage distribution of correct matches, incorrect matches, and no matches, with each column representing an individual observer identified by professional group. The three forensic odontologists are labeled FO1-FO3, the eight oral radiology specialists are labeled OR1-OR8, the six dentists trained in the basics of disaster victim identification labeled DVI1-DVI6 and the eight dental students are labeled DS1-DS8.



The incorrect and not found matches were distributed as follows: among the DVI-D, four out of six (66%) had either errors or cases without matches; among the DS two of eight (25%) had errors or cases without matches. Out of the eight incorrect matches, six (75%) were classified as probable and the remaining two (25%) as possible. None of the ORs and FOs (0%) committed any errors (Figure 2).

To explore whether case characteristics influenced matching accuracy among the less experienced groups, cases correctly matched by DVI-D and DS were compared with those resulting in errors. No significant differences were found regarding simulated victims age, interval between examinations, visible radiographically detectable identifiers nor sex.

Radiographically detectable identifiers used for matching

Fillings were the primary radiographically detectable identifier used for matching across all groups, with slight but significant differences between them ($p < 0.001$). The highest use was

seen among ORs (94.0%), followed by FOs (90.7%), DVI-trained dentists (79.3%), and DS (73.5%).
Prosthodontics were used more frequently by ORs (61.5%) than by DVI-D (51.3%), FOs (49.3%), and DS (40.5%) (p = 0.004).
Tooth anatomy was used significantly more often by DS (58.5%), ORs (52.5%), and FOs (42.7%) than by DVI-D (18.7%) (p < 0.001). A similar trend was noted for the "Other" category, where ORs and DS reported use in 69.0% and 48.0% of cases, respectively, compared with 21.3% for FOs and 15.4% for DVI-D (p < 0.001).
The most pronounced difference between groups was observed for bone anatomy: ORs used this characteristic in 75.5% of cases, compared with only 10.7% for FOs, 2.7% for DVI-D, and 1.0% for DS (p < 0.001). A complete breakdown of matching characteristics by group is presented in Table 3.

Table 3. The count and percentage of each radiographically detectable identifiers used for matching by the oral radiology specialists (ORs), forensic odontologists (FOs), dentists trained in the basics of disaster victim identification (DVI-D), and dental students (DS).

Match using	FOs (N=3)	ORs (N=8)	DVI-D (N=6)	DS (N=8)	p-value
Bone anatomy	8 (10.7%)	151 (75.5%)	4 (2.7%)	2 (1.0%)	< .001
Fillings	68 (90.7%)	188 (94.0%)	119 (79.3%)	147 (73.5%)	< .001
Tooth anatomy	32 (42.7%)	105 (52.5%)	28 (18.7%)	117 (58.5%)	< .001
Prosthodontics	37 (49.3%)	123 (61.5%)	77 (51.3%)	81 (40.5%)	0.004
Other	16 (21.3%)	138 (69.0%)	23 (15.3%)	96 (48.0%)	< .001

N = number of observers

Matching confidence

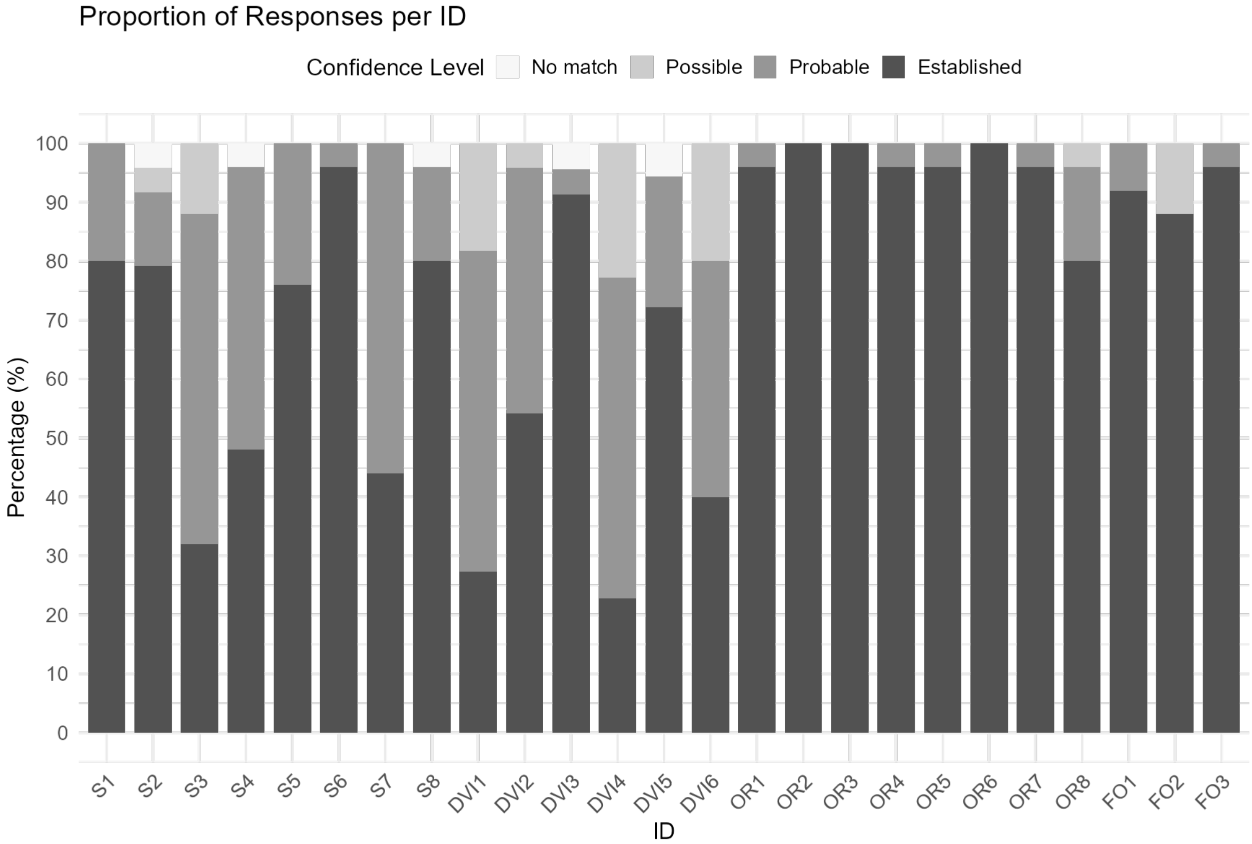
The matching confidence varied greatly between the groups, with the ORs selecting "established" in 95.5% of cases, compared with 92.0% for the forensic odontologists, 50.7% for the DVI-D, and 66.8% for the DS (p < 0.001). Pairwise comparisons revealed significant differences between ORs vs DVI-D (p < 0.001), ORs vs DS (p <0.001), FOs vs DVI-trained dentists (p < 0.001), and FOs vs DS (p < 0.001). The difference between DVI-D and DS was also significant (p = 0.005), while there were no significant differences between ORs and FOs (p = 0.63). For detailed distribution see Table 4.
There was also great individual variation among DS and DVI-D, with some almost matching the confidence of the ORs (Figure 3). Overall, the ORs and FOs demonstrated significantly higher confidence than the DVI-D and DS.

Table 4. The count and percentage of confidence classifications for oral radiology specialists (ORs), forensic odontologists (FOs), dentists trained in the basics of disaster victim identification (DVI-D), and dental students (DS).

Confidence	FOs (N=3)	ORs (N=8)	DVI-D (N=6)	DS (N=8)	*p*-value
No match	0 (0.0%)	0 (0.0%)	2 (1.5%)	3 (1.5%)	< .001
Possible	3 (4.0%)	1 (0.5%)	15 (11.2%)	4 (2.0%)	
Probable	3 (4.0%)	8 (4.0%)	49 (36.6%)	59 (29.6%)	
Established	69 (92.0%)	191 (95.5%)	68 (50.7%)	133 (66.8%)	

N = number of observers

Figure 3. Bar chart visualization showing the percentage distribution of match confidence levels, with each column representing an individual observer identified by professional group. The three forensic odontologists are labeled FO1-FO3, the eight oral radiology specialists are labeled OR1-OR8, the six dentists trained in the basics of disaster victim identification labeled DVI1-DVI6 and the eight dental students are labeled DS1-DS8.



DISCUSSION

The present study demonstrates that the four professional groups differed significantly in both accuracy and confidence when performing matching between PM PRs and AM intraoral radiographs. FOs and ORs correctly matched all cases—the only acceptable outcome in real disaster scenarios—compared with 94.7-98.5% among the less experienced groups. Confidence levels had a similar pattern, with FOs and ORs classifying 92–96% of matches as established, compared with 51–67% for the less experienced groups.

The significantly higher matching confidence among ORs and FOs compared with the less experienced groups was expected and can be attributed to their specialized expertise, as they routinely analyze and interpret a wide variety of radiological images, consistent with previous findings.[14,25–27] That ORs, despite not performing dental identifications, achieved identical matching accuracy as FOs suggests that their expertise may be an asset in DVI scenarios. The high proportion of established matches in this study reflects that most cases contained multiple distinctive identifiers, making established matches achievable. However, real-life scenarios, with fewer distinguishing radiographically detectable identifiers, may warrant greater caution in confidence to reduce the risk of false identifications.[11,25,26,31,32]

The groups also differed in their use of radiographically detectable identifiers. As expected, fillings (74-94%) and prosthodontics (41-62%) were the most commonly used radiographically detectable identifier for matching, consistent with previous findings.[11,21,27,32,33] Fillings are relatively easy to compare between PR and intraoral radiographs and tend to vary in terms of placement, material, outline, and condition between individuals. Similarly, prosthodontics can be highly distinctive in appearance, placement, and materials.[5,27] As restorations become less prevalent, features such as tooth morphology, rotation and placement, as well as jawbone structure, pathologies, and any

injuries or alterations become more valuable for identification. [5,22,26,31,34]
The largest discrepancy was regarding the use of bone anatomy, with ORs using bone identifiers to a very high degree (75.5%), compared with 10.7% for FOs, 2.7% for DVI-D, and 1.0% for DS, despite only 32% of cases having distinguishing bone identifiers. This pattern was specific to ORs rather than a general trend among experienced observers, which likely reflects that they are trained in comprehensive radiographic assessment and apply that methodology to matching, while FOs are trained to focus on the most relevant identifiers to establish an identification. [9,21,31,32] While both approaches produced accurate results, the extensive use of bone anatomy among ORs in this study was not warranted and could represent a less efficient allocation of attention and time. The results also suggest that each group could benefit from complementary training in the other's area of expertise. Training in assessing bone anatomy (e.g. sinus outlining and trabecular bone patterns) could be particularly important for preparing for future scenarios where dental restorations may be fewer or less distinctive. [5,27,35]
Another notable finding was that the DVI-D had the lowest accuracy (94.7%) and confidence (50.7% established matches) compared to all the other groups, including DS. Although DVI-D receive annual training, often provided by FOs, this training primarily focuses on PM examination and AM transcription rather than the radiographic comparison. This combination of infrequent practical application and long time between training sessions affects knowledge and skill retention and might explain this finding. [36] However, in a real DVI operation the DVI protocols specify that quality control should be performed which would improve matching and identification accuracy.[1,37] These results suggest that matching in the reconciliation phase should be performed by experienced FOs or possibly ORs. Further, this suggests that DVI training programs should incorporate more radiographic comparison and matching exercises to ensure that DVI-D are well-prepared to carry out all stages of dental identification in future DVI incidents [21,25–27,32], while being efficient and accurate.[38]
In both single-case identifications and DVI incidents, time and accuracy are of the essence. [38,39] In this study, less experienced dentists (DS and DVI-D) generally required more time to perform matching yet produced more errors and expressed lower confidence in their matches, making them less suited for matching tasks. Furthermore, long working hours and intense external pressure during DVI operations [39], can increase the risk of errors, which suggests that the most experienced personnel should assume primary responsibility for matching and quality assurance.
Although less experienced personnel performed inferiorly in matching tasks, they may contribute valuable support in other aspects of DVI operations. Real-life incidents involve more than just matching: PM examinations, AM data transcription, and report writing also need to be performed, e.g. a general dental extensive clinical experience can be particularly beneficial for conducting PM examinations. [40] These considerations highlight the importance of maintaining a network of highly trained and experienced personnel who can lead and support their less experienced colleagues, while simultaneously handling the most challenging tasks in DVI incidents such as performing matching, especially with complex images such as PRs and CT/CBCT. [11,21]
Conventional PRs present challenges due to positioning requirements, distortions, and overlapping anatomical structures. [11,23,33] While CT/CBCT-reconstructed PRs can be more easily obtained postmortem and configured to better match AM images, they are more susceptible to artifacts from metal restorations and often have lower spatial resolution. [23] Nevertheless, conventional and reconstructed PRs are generally considered comparable in clinical and forensic contexts [11,21,33], and our findings may therefore be applicable to CT/CBCT-based identification, though this warrants further evaluation.
A limitation of the study is that conditions were not fully standardized across the participant groups, especially regarding the use of multiple screens. The study design also imposed a time limit on the observers which may have been a source of stress, potentially leading to errors. [38] However, if time pressure were a significant factor, one would expect it to affect all groups. The fact that FOs and ORs achieved the highest matching accuracy while using the least amount of time suggests that experience, rather than time constraints, determined performance. Less experienced observers performed inferiorly

despite utilizing all available time, and while additional time might have improved their results [38], real-world disaster scenarios rarely afford such flexibility.
The use of more AM cases (30) than PM cases (25) is a strength of this study, as it prevented observers from using a process of elimination to match the final cases, which would have artificially inflated accuracy rates. By including five AM cases without a PM match, observers were required to actively identify matches based on radiographically detectable identifiers rather than simply pairing remaining cases by exclusion. The study design could have been strengthened by including PM cases without an AM match. Building on this, future studies could also evaluate all phases of the DVI process across professions, including transcription of AM and PM examinations using INTERPOL dental codes.
Overall, our results emphasize the importance of experience in detecting subtle details and indicate that additional training is required for less experienced personnel to improve both accuracy and efficiency. Beyond reducing errors, such experience may also mitigate the post-traumatic stress and risk of burn-out commonly associated with DVI incidents. [41,42]

CONCLUSION

Conventional PRs could be used for identification with high accuracy, particularly when interpreted by experienced observers. FOs and ORs had significantly higher matching accuracy and confidence than the less experienced groups, emphasizing the critical importance of observer experience. The findings support that ORs may be an asset in DVI operations. Fillings were the most commonly used identifier, while ORs notably utilized bone anatomy extensively. PRs reconstructed from PM CT could be valuable for initial screening and for narrowing potential matches in comparative dental identification, but this requires further investigation.

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