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Forensic Dentistry and Disaster Victim Identification (DVI) in Indonesia

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1   **Forensic Dentistry and Disaster Victim Identification (DVI) in Indonesia**

2

3   **Abstract**

4   The forensic dentist plays an important role in the disaster victim identification (DVI) operations.
5   The first aim of this study was to explore the opinions of Indonesian dentists on the importance
6   of dental records and the respective awareness of Forensic Dentistry. The second aim was to
7   investigate the basic profile of the Indonesian dentists and their experiences working in the DVI
8   operations. Two web-based surveys (S1 and S2) were sent to 360 Indonesian dentists and 8
9   Indonesia-DVI team members, respectively. Results for S1 showed that most dentists (305 out of
10   341) are aware of the field and the importance of dental records in human identification;
11   however, only 26% of dentists always compile a complete dental chart of the patient. DVI team
12   members (6 out of 8) have an academic background in the field and only the minority experienced
13   difficulties in deployments. Indonesia is susceptible to natural disasters and dentists proved to
14   be important in DVI. Although the Ministry of Health of Indonesia have provided guidelines, the
15   recording of dental data is not up to standard. A regular and systematic monitoring by the dental
16   councils to every dental clinic would certify if dentists are compiling and keeping accurate dental
17   records.

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19   Keywords: Forensic Dentistry, Indonesia, Dental records, DVI

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30   **Introduction**

Forensic odontology is the part of dentistry that deals with examination of dental evidence in the interest of justice[1]. One of the scopes of forensic odontology is the identification of a single body or multiple ones ~~(and body parts)~~ using comparative dental analysis which is the comparison between *antemortem* (AM) and *postmortem* (PM) dental records. On the one hand, accurate dental records can be used in ~~defend against~~ any clinical and/or legal problems that might arise[2]. On the other hand, dentists should be aware that dental records play a vital role in the comparative dental analysis[3, 4].

DVI is the process of recovering and identifying deceased people and human remains. It is also an important part of the emergency management of a mass fatality incident or disaster[5]. The INTERPOL Disaster Victim identification (DVI) guideline acknowledges three primary identifiers as the most reliable means of identification: friction ridge analysis, comparative dental analysis and DNA analysis[6]; therefore, teeth are recognized as evidence for comparative dental analysis and, also, can be source of ~~PM~~ DNA samples[7].

In the early 2000's, researchers discussed the need to standardize dental record in Indonesia and also the need to create a nation-wide forensic odontology curriculum in Dental School[8]. ~~and~~ A DVI training for dentists[9] was also suggested. Currently, there are more than twenty dental schools in Indonesia, and some of those include forensic dentistry in the undergraduate dental curriculum, under the department of oral biology or radiology. The total number of credits differs according to the university. The credit hour which is 1 SKS (or *Satuan Kredit Semester*) is equivalent to one hour of teaching per week in one semester. Since 2011/12 to date, there is only one Forensic Odontology master program consisting of four semesters in the University of Indonesia.

Indonesia is a volcanically active country, containing 150 volcanoes that are part of the world's Ring of Fire[10]. Consequently, this country is prone to frequent earthquakes and volcanic eruptions[11]. These natural disasters can result in a large number of commingled human remains resulting in challenges to the DVI team[11]. Disasters have occurred in Indonesia as far back as 1883 where the Krakatoa Volcano erupted and resulted in more than 30,000 casualties. In 2004, an earthquake occurred on the west coast of Sumatra, Indonesia. The sea floor was disrupted and tsunami waves produced the "Boxing Day Tsunami" [12]. As a consequence, the largest disaster victim identification operation in history took place[13]. A good number of disasters happened between 2013 and 2018 and resulted in great number of deaths caused by landslide (1,130 people), tornado (190 people), earthquake (159 people), volcanic eruption (38 people), forest fire (31 people) and high tide (15 people). Man-made disasters included: transportation accident (1,031 people), flood (909 people), industrial effect (34 people), social conflict (22 people), fire (20 people) and also terror attacks (7 people)[14]. In 2018, the international media coverage reported the Lombok earthquakes of July 28 and August 5, the earthquake and tsunami in Sulawesi on September 28 and the tsunami in Sumatra on December 22[15].

In 1997, the Silk Air flight MI-185 flying from Jakarta to Singapore crashed in the Musi River, Palembang and two of the identifications used teeth as evidence for the first time in Indonesia[16]. Although the literature on DVI in Indonesia is scarce, records show that the DVI organization in Indonesia was pioneer by holding the first Interpol DVI Pacific Rim Meeting on 25-27 January 2001 in Makassar. ~~Later, on September 29,~~ In 2004, an agreement between the Ministry of Health

and the Indonesian National Police on the Guidelines for the Identification of disasters established the Indonesian National DVI Team[17]. The main aim of this research was to explore the opinions of Indonesian dentists on the importance of dental records and the respective awareness of Forensic Dentistry. The second aim was to investigate the basic profile of the Indonesian dentists and their experiences working ~~on~~ in the disaster victim identification (DVI) operations.

Materials and Methods

Two surveys (S1 and S2) were designed using Google Forms (© 2015 Google Inc.) in *Bahasa Indonesia* language*.* S1 consisted of ten closed-ended questions and aimed to explore the awareness of forensic dentistry (questions 1 - 3) and the opinions on the importance of AM records (questions 4 – 10). S2 consisted of five closed-ended questions and two open-ended one and aimed to investigate the basic profile of the Indonesian dentists and their experiences working on the disaster victim identification (DVI) operations. The questions are shown in table 1 in English language.

S1 was sent to 360 anonymized dentists (government and private sectors) by email and forensic dentists were excluded. S2 was sent to dentists who are members of the Indonesia DVI team. Dental students, dental assistants and dental technicians were excluded from both surveys. Within three weeks, the author stopped accepting responses and answers were analyzed using descriptive statistics (graphs).

Table 1 – Questions of S1 and S2 in English language.

Survey 1 (S1)	Survey 2 (S2)
First question – How many years have you been working as a dentist?	**First question** – How long have you been working in the DVI field?
Second question – Are you aware of Forensic Dentistry?	**Second question** – What is your latest qualification/degree?
Third question – If you answered 'yes' to the question above, what scope of Forensic Dentistry are you aware of?	**Third question** – What are the disasters that you have you been involved with?
Fourth question – Do you know that dental records are used in human identification?	**Fifth question** – How long have you been deployed?
Fifth question – If you answered 'yes' to the question above, which dental records are used to identify bodies?	**Sixth question** – Have you encountered difficulties whilst working in Indonesia?
Sixth question – Do you always compile a full dental chart of a new patient?	**Seventh question** – If you answered 'yes' to the question above, what were the difficulties?
Seventh question – If you answered 'sometimes' and 'never' to the question above, what is the reason that prevents you from doing?	

Eighth question – Do you organize the patient's dental records yourself?	
Ninth question – How long do you (or your clinic) need to keep the patient's dental records?	
Tenth question – What type of dental chart do you use?	

Analysis of S1 Results

~~Out of 341,~~ A total of 341 dentists replied to the survey and 196 dentists (57%) have 'less than 5 years of experience' whilst 84 dentists (25%) have '5-10 years of experience' followed by 61 dentists (18%) whose experience 'exceed 10 years'. ~~with 'more than 10 years of experience'.~~ Overall, 280 dentists (82%) have less than 10 years of experience. Considering awareness of Forensic Dentistry, 305 dentists (89%) were 'aware' as opposed to 2 dentists (1%). A number of 34 dentists (10%) chose 'not sure' as answer. The younger generation is more aware of this branch of dentistry because 187 out of 305 aware dentists (58%) have 'less than 5 years' of experience and an additional number of 17 dentists answered about the scope of Forensic Dentistry totaling 322 answers. A total of 90 dentists (26%) are aware of the different scopes including 'human identification, bite mark analysis, DVI and age estimation'. Following that, 81 of the dentists (24%) are aware of 'human identification' solely. 46 ~~of the~~ dentists (13%) acknowledged only 'DVI' as scope whilst 23 dentists (7%) are aware of bite mark analysis only. Analyzing the scopes individually, 'human identification' was the most cited (229; 71%), followed by 'DVI' (182 dentists; 56%), 'bite mark analysis' (152 dentists; 47%) and 'age estimation' (128 dentists, 40%). ~~Distribution of the answers~~ The combination of scopes of Forensic Dentistry can be seen ~~in detail~~ in Figure 1.

Figure 1 – ~~Distribution of information about scope of dentistry among~~ **Combination of scopes of Forensic Dentistry according to dentists that are aware of the field (total number of respondents = 322).**

339 out of 341 dentists (99.4%) were aware that dental records are used in human identification. Two dentists (0.6%) were 'not sure' and none answered, 'don't know'. The types of dental records in the survey included: dental charts, dental radiographs, dental casts and other (please specify). 'Dental charts' were considered ~~to be~~ the most used type of dental record to identify a body (148 dentists, 44%). The combination of 'dental charts, dental casts and dental radiographs' was mentioned by 128 dentists (37%), followed by 'dental charts and dental casts' (26 dentists; 8%), 'dental charts and dental radiographs' (20 dentists; 6%), 'dental radiographs' (9 dentists; 4%) and 'dental casts' (5 dentists; 1%). A number of 3 dentists answered 'dental casts and dental radiographs', 'dental charts, dental casts, dental radiographs and other (lip print) and 'dental charts, dental casts, dental radiographs and other (extra-oral radiograph). The overall distribution is shown in figure 2.

Figure 2 – Distribution of information about types of dental records used in human identification (total number of respondents = 339).

Only 88 out of 341 dentists (26%) always compile a full dental chart of a new patient. Most of the dentists, 207 (61%) answered 'sometimes' and 46 dentists (13%) answered 'never'. Overall, 253 dentists (74%) would not provide accurate AM dental records for possible human identification by dental means. 'Time consuming' (132 dentists, 52%) was considered the most cited reason followed by 'absence of dental chart template' (88 dentists, 35%). Other reasons were specified by 33 dentists as seen in figure 3. ~~contemplated as one of the reasons and might suggest lack of proper training or struggle with a great demand of patients. Surprisingly, 88 dentists (35%) mentioned 'absence of dental chart template'. Figure 3 shows the other reasons (31 dentists) such as 'not specified' (15 dentists, 48%), 'Don't remember' (7 dentists; 23%) and 'Only treatment without recording' (3 dentists; 8%).~~

Figure 3 – Other reasons for not recording ~~why dentists don't record~~ a full dental chart of a new patient (total number of respondents = 33).

Most of the dentists (234 dentists; 69%) 'never' organize their patient's dental records and this is a role taken by the members of the clinic team. A small number of 75 dentists (22%) 'always' organize their dental records themselves and 32 dentists (9%) responded 'sometimes'. Interestingly, most of the dentists (260 dentists; 76%) keep their dental records for 'more than 5 years'. Only 68 dentists (20%) keep their dental records for '1-2 years' and a total of 10 dentists (3%) keep their dental record for '1 year only'. Only 3 dentists (1%) 'never' keep the dental records and they might well be the ones that don't compile dental chart. The majority of ~~the~~ dentists (284 dentists; 83%) prefer 'manual dental chart' as opposed to 46 dentists (14%) who prefer 'digital dental chart'. 4 dentists (1%) prefer a 'combination of both' and only 2% answered 'none of above'. ~~to record their data, next 'computerized odontogram' (46 dentists; 14%) and 4 dentists (1%) prefer a 'combination of both'. Only 2% answered 'none of above'.~~

Analysis of S2 results

According to the results, the Indonesia DVI team is composed of Indonesian natives only and they presented an academic background in Forensic Dentistry such as: ~~all Indonesia DVI team members are Indonesian native and presented an educational background in Forensic Dentistry:~~ 'Diploma in Forensic dentistry' (2 dentists; 33%), 'PhD in Dental Sciences' (1 dentist, 17%), 'Master's in Forensic Dentistry' (2 dentists; 33%) and 'Master in Radiology' (1 dentist, 17%). Four dentists (67%) confirmed 'more than 5 years' of experience in DVI and the other two dentists stated '1-2 years' and 'less than 1 year' of experience separately. The length of deployment ranged from 'one week' (1 dentist, 17%), '2 weeks' (3 dentists; 50%) to '3 weeks' (2 dentists; 33% each). Most of ~~the~~ dentists (4; 67%) opined that working in ~~the~~ Indonesia~~'s DVI~~ is not difficult as opposed to 2 dentists (33%) who ~~had~~ expressed a different opinion. The difficulties were cited as follows: (a) not enough coordination between the units; (b) not enough equipment available; (c) not enough trained people; and d) coordination between DVI team and universities is not great. ~~The disasters that dentists have been deployed~~ Deployments included the Tampomas Shipwreck (1981), Silk Air Crash (1997), Trenggalek Shipwreck (2001), JW Marriott Bombing (2003), First Bali Bombing (2005), Ritz Caltron Bombing (2009), Shukoi Plane Crash (2012), Middle East Illegal Immigrant Drowning (2013), Air Asia Plane Crash (2014), Trigana Plane Crash (2015), Sarinah Bomb (2016) and Cianjur 1/2 Road Traffic Accident (2017).

Discussion

Although the literature on awareness of forensic dentistry among Indonesian dentists is poor, this study proved that most of the Indonesian dentists are aware of this field similarly to Indian[18] and Pakistani dentists[19]. Globalization of the media industry, search for dental specialties and the number of DVI operations throughout the country may have potentially increased the awareness. The results indicated that human identification and DVI were known scopes of forensic dentistry by the dentists. ~~are strongly correlated scopes known by the dentists. In *Bahasa Indonesia* language, bite mark analysis is translated as~~ *Analisis Gigitan* (*Gigi* = teeth) means bite mark analysis in *Bahasa Indonesia* language, therefore, dentists could have assumed it as scope. ~~The scope of a~~Age estimation was the least known scope even though dental development and eruption is part of the undergraduate dental curriculum and it serves as base for age estimation. ~~by dental means.~~

The availability and accuracy of AM records is a major determinant in the comparative dental analysis and include dental charts, study casts, dental radiographs and intra and extra-oral photographs[20]. 76% of the dentists, aware of this fact or not, keep the dental records for more than 5 years. A similar research conducted in Saudi Arabia, showed that 44% of the dentists keep the dental records forever[21], and other study proved that 38% of Indian dentists keep the dental records for a certain period[22]. By recording and keeping an accurate dental chart, dentists can review the patient's completed treatment and they can also plan the next one[23,24]. Moreover, dental records are frequently called upon in the medico-legal setting, where civil legal action is taken against a dentist[25].

An examination of the entire state of the patient's mouth must be thoroughly recorded on the first visit in order to give an overall picture of the patient's oral health; therefore, the dentist should spend more time on patients who make first visit to the clinic[26]. Most of the respondents prefer manual dental charts which allow dentists to personalize his/her way of charting the dental treatment[27]. Electronic dental charts provide a better graphic description because they contain a legend of the symbols and colors used in the pictorial dental chart[20]. Not only the absence of AM dental records but also the presence of inaccurate or incomplete dental records, with poor standard of record keeping[27] could be a challenge for the comparative dental analysis.

Most Indonesian dentists do not use a standardized dental chart that could facilitate its interpretation for the identification of disaster victims[28]; therefore, the Indonesian Dental Association should stress the importance of comprehensive AM dental records following the National Standard of Dental Record (FDI system) released by the Ministry of Health of Indonesia[9]. It is important to mention that dental record should include the patient identity, general condition of the patient, dental chart/treatments, and identity of the dentist. Also, the Indonesian Statute No. 29 in 2004 of Medical Practice subsection 46 (1) states that "*Every doctor and dentist who performs medical practice is obliged to make medical records*"[26].

Despite all reassuring results proving that Indonesian dentists are aware of both forensic dentistry and the importance of dental records, the majority do not compile a complete dental

chart of their patients on the first visit to the clinic (only 26%). Segregated information about private or government clinics could investigate the possible reasons. For instance, a study explored the contents of dental records at private dental practices in Bandung (Indonesia) and results showed that 73% of odontogram section of dental records ~~have not been~~ were not completed[26]. Also, dentists from different areas and islands in Indonesia, might be exposed to different types of dental records. A regular checking and systematic monitoring by the dental councils to every dental clinic would certify if dentists are making and keeping accurate dental records. Most of ~~the~~ dentists do not organize the dental records themselves so the responsible ones must be trained to keep contemporaneous, complete and accurate dental records for every patient. Every dental practice should adopt the recommended National Standard of Dental Record in order to follow the minimum requirements for recording and maintaining dental records.

In comparative dental analysis, dental radiographs are preferred to written records ~~for the identification~~ because of their objectivity for visual comparison[16]. Commonly, bitewings or periapical radiographs are used for intraoral views, and orthopantomograms (OPGs) are used for extraoral views. They can also be classified by method of acquisition into either digital or analog radiographs[29]. In the mortuary, forensic dentists should ~~have access to intra-oral radiography and it is then a straightforward matter of duplicating~~ be able to duplicate the position and angulation of the AM radiograph to allow a comparison of the shape and size of restorations between the two radiographs. In the absence of restorations, other radiographic features such as pulp chamber anatomy, root shape and even bone trabeculae should be assessed[20]. In October 2016, the Indonesian Nuclear Energy Regulatory Agency (Badan Pengawas Tenaga Nuklir, BAPETEN) had issued a total of 1315 licenses for dental radiography units, indicating a very large quantity of dental radiology practices scattered around the country[30]. This is a strong indicative of the prevalent use of diagnostic radiology devices for dental purposes. Consequently, a good number of dental radiographs should be provided for comparative dental analysis.

In this study, only a minority of the DVI team members mentioned difficulties in deployments such as coordination, funding and the need of experts in the field. In order to avoid identification delays, more trained forensic dentists are needed to handle the future mass disasters in Indonesia[9]. Due to the different specialties working together, members should have a clear understanding of their roles and a form of accreditation should formalize the level of training desirable in the team[11, 31, 32]. ~~, providing an understanding of what occurs at an incident and their roles. In a DVI operation, logistics is important because different specialties such as forensic pathologists, forensic dentists, forensic anthropologists, forensic molecular biologists, finger print experts work together.~~ It was also mentioned that there was no clear coordination between the universities and the DVI team; therefore, forensic dental bodies should formally liaise with universities and dental councils in order to officially recognize the field of forensic odontology[33] with consequent effect on DVI operations. ~~In this study, climate was not mentioned to be a challenge even though Indonesia is located in the tropical region and challenges can be encountered. For instance, the hot climate increases the rate of decomposition, the odors from decomposition can cause concern about epidemics and refrigeration for preserving human remains might not have enough capacity.~~

Conclusions

Indonesian dentists are aware of Forensic Odontology and the importance of dental records in human identification. Indonesia is susceptible to natural disasters and dentists proved to be important in DVI, therefore more importance should be given to dental records and expansion of the field. Although the Ministry of Health of Indonesia have already provided guidelines on dental chart, Indonesian dentists are not recording up to standard. A regular and systematic monitoring by the dental councils to every dental clinic would certify if dentists are compiling and keeping accurate dental records. ~~Although the Ministry of Health of Indonesia have already provided guidelines on dental charting, Indonesian dentists are not recording up to standard. A regular and systematic monitoring by the dental councils to every dental clinic would certify if dentists are making and keeping accurate dental records. Indonesia is susceptible to natural disasters and Indonesian dentists proved to be important in DVI, therefore more importance should be given to dental records and expansion of the field~~.

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