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**A new website to aid the interpretation of ante-mortem dental records:**

**[www.internationaldentalcharts.org](http://www.internationaldentalcharts.org)**

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## **ABSTRACT**

*The INTERPOL (International Police Organization) Disaster Victim Identification forms represent a global standard for mass disasters and the collection of international ante-mortem dental records. These records can now be interpreted more easily with the help of a new online dictionary of dental terminology for translating dental charts from several languages into English.*

*The free website launched in 2013 ([www.internationaldentalcharts.org](http://www.internationaldentalcharts.org)) is the result of a M.Sc project on international dental charts: Guide of International Dental Charts translated into English – decoding international ante-mortem dental charts for INTERPOL's Ante-mortem (AM) Disaster Victim Identification (DVI) forms (Section F2), completed in 2011.*

*The aim of this study was to analyze the tooth numbering system, symbols and abbreviations used on dental charting worldwide. A letter was sent to the national dental associations of the 188 INTERPOL member countries, addressing the goals of the project and asking for samples of dental charts.*

*A total of 45 countries replied and 32 common dental alterations were selected for translation, such as: decay, filling and extraction. Their symbols and/or abbreviations used were summarized in various languages.*

*More than one system of dental notations was used in the same country whereas there was an absence of standard systems in other countries. Some of the samples of charts received were of little value. However, a fair amount of useful information and detail was found in most of them.*

*This free consultation website could be useful when the handwriting, symbols, and abbreviations on the ante-mortem dental charts are not clear. It will be particularly applicable when ante-mortem x-rays and casts are not available.*

**KEYWORDS:** dental chart, disaster victim identification, ante-mortem dental record, Interpol DVI form

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## INTRODUCTION

Nowadays, increased travel has led to a higher probability of fatality occurring abroad and deaths from natural disasters present a rising global trend.<sup>1</sup> Disaster victim identification (DVI) is a process that brings together ante- and post-mortem information, to make a positive identification by scientifically acceptable means.<sup>2</sup>

Forensic dentists are highly valuable in case of mass disasters as the use of dental records is less costly than other methods such as the use of DNA.<sup>3</sup> The main factors involved in successful dental identification are the collection of ante-mortem dental records and their accuracy, and the level of post-mortem deterioration.<sup>4</sup> The new website could be consulted to clarify some information received from ante-mortem dental charts worldwide focusing on the INTERPOL DVI forms which have been successfully tested and accepted internationally.<sup>2</sup>

Studies on the dental analysis following the South Asian Tsunami of 2004, concluded that reliable ante-mortem records speed up the dental identification process.<sup>5</sup> The dental ante-mortem data of interest is: written records, X-rays, casts or models, intra- and/or extra-oral photographs and recollections of the dentist or acquaintances.<sup>6</sup> Notably, the dental chart represents a particular individual's dentition with a unique combination of shapes, restorations, colors and defects.<sup>7</sup>

Interpretation of the large variety of tooth nomenclature and dental charting systems used throughout the world can be a very challenging task for the forensic dentist.<sup>8</sup> The ante-mortem team has the task of deciphering difficult handwriting, making sense of codes and abbreviations, translating foreign languages and interpreting notations which very often may be nearly illegible.<sup>9</sup> For those reasons, a mitigation in this process is needed.

## Considerations in the use of dental charts for forensic purposes

In disaster response scenarios, dental records arrive from various parts of the world in all shapes and forms. Not only are different systems used around the world, but also there are a variety of different symbols and abbreviations depending on the preferences of the individual dentist.<sup>7,9</sup> Only original dental records should be provided for forensic use, as photocopied dental charts and treatment notes do not contain the often-critical multi-colored notations that are present on the original documents.<sup>8</sup>

It is important to note the time elapsed between the time when the ante-mortem evidence was established and the time of the disaster.<sup>10</sup> Relevant records may be filed at one or more dental surgeries and all dental information must be gathered and interpreted.<sup>11,12</sup>

Forensic dentists frequently find that some ante-mortem dental records are inaccurate, incomplete or confusing, with poor standard of clinical dental record keeping.<sup>6,13</sup> At the first visit, the dentist completely charts all preexistent restorations and missing teeth. Any treatment performed by the dentist thereafter should be added to this baseline.<sup>6</sup> Dentists tend to undertake only those treatments for which they are paid and no one is paid for the additional work involved in marking dentures or full mouth charts. For this reason, such extra work should be made a legal requirement.<sup>13</sup>

The diversity of systems has led to errors in the practical transcription of anamnesis and clinical information.<sup>14</sup> Furthermore, there are numerous classifications of dental interventions while *there is no* standard international dental charting system.

Ante-mortem dental data is customarily available for patients in developed countries whereas dental and medical records are usually scanty or non-existent in those countries with poor standards of

health care.<sup>15</sup> Data recorded in foreign languages also presents challenges for the forensic dentist. In addition, the period of time which dental records are kept may not be very long.<sup>8</sup>

### Possible errors in dental charts

One of the most common errors is the incorrect registration of dental restoration; there is often confusion when noting down the extension of a filling from the occlusal surface onto a buccal or lingual surface.<sup>16</sup> This kind of detail becomes very important when comparing ante-mortem and post-mortem charts. There may be mistakes about lacking of noting an enlarged filling. An example of noting an enlargement is when (*MO – mesio/occlusal – amalgam* becomes *MOD – mesio/occluso/distal – amalgam*).<sup>17</sup>

Another critical point is charting the absence of teeth. Some dentists do not record this information.<sup>18</sup> For instance, if a person has a congenital absence of teeth – the teeth usually involved are the third molars, the second premolars and the maxillary lateral incisors.<sup>6</sup> Various dentists may diagnose the absence of teeth differently depending on if they determine whether the first or second premolar is missing. Conversely, no accommodation is made for supernumerary teeth in any of the dental systems and these rare events are simply left out of the chart.<sup>18</sup>

Upon cursory examination, the ante-mortem dentist may have erroneously recorded the second molar as the first molar, and any subsequent caries or restorations noted regarding the tooth would be improperly assigned to the first molar. Less commonly, the third molar may drift into the slot of a previously lost second molar, especially when early extractions have been performed.<sup>10, 19</sup> To the unaware, this drifting makes it appear as if the third molar is missing, which is possible in both the maxilla and the mandible.<sup>15, 16</sup> The canines and incisors are rarely mischarted.<sup>20</sup> However, information

about incisors and canines is often scarce because these areas are seldom covered by radiographs.<sup>21</sup>

When quoting teeth by name using both FDI (International Dental Federation) and Universal systems, each tooth has a unique identifier.<sup>18</sup> Even though the FDI system is recommended by most of the international health organizations and adopted by INTERPOL, no such system has gained full international acceptance.<sup>7</sup> Nevertheless, the interpretation of tooth notation is not a difficult task, once the notations have been learnt. The interpretation of apparent chart errors and the numerous abbreviations used by dentists are the greatest challenges.<sup>20</sup>

In addition, a forensic dentist is also apt to come across cases of suspected dental negligence or fraud while investigating ante-mortem dental records. Some examples of fraud could include: performing dental procedures that are unnecessary, charging a fee for a service that was never actually rendered and coding a simple procedure as a more complex one in order to charge more.<sup>22</sup>

### METHOD

The research method used to gather international dental chart samples was a letter addressed to the national dental associations of 188 INTERPOL member countries.

The letter explained the aim of the project and requested samples of dental charts used in the country (table 1). A total of 32 dental alterations in English were quoted in the letter (table 2) requesting the dentist to specify the terminology, symbol and/or abbreviation of those alterations in their own language, even if neither of them was represented in the dental charts supplied.

### RESULTS

A number of 43 countries, out of 188, did not participate in the research because there was no dental association to be contacted; a total of 145 were contacted but 100 did not reply; only 45 replied

**Table1:** Details about the letter

<b>Enquires in the letter</b>
<p>a) A blank dental chart form, which has been in use in the country, in order to analyze the type of dental notation (FDI, Universal System, etc).</p> <p>b) Information about terminology, abbreviations and code (symbols) for the 32 common dental alterations/works quoted.</p>

**Table2:** The 32 dental alterations

<b>Alterations linked directly to teeth</b>	<b>Alterations linked to dental laboratory's work</b>
<p>Amalgam filling, cavity (decay), composite filling, congenitally absent tooth, extraction, fissure sealant, fractured tooth, glass inomer filling, impacted tooth, missing tooth, root filling, root remaining and temporary filling.</p>	<p>Bridge, cobalt-chrome denture, crown, full gold crown, implant, inlay, lower/upper partial denture, lower/upper full denture, metal/ceramic crown, onlay, orthodontic appliance (fixed), orthodontic appliance (removable), pins, porcelain bonded, crown, porcelain jacket crown, post crown and temporary crown.</p>

(table 3) with substantial information about the 32 common dental alterations; their symbols and/or abbreviations were summarized in various languages. The amount of detailed information was great and a compilation can be viewed at the website (examples in table 4).

Most of the dentists explained that there is no standard system of dental charting in their countries and there are big variations between universities, private and governmental dental practices.

The dentists that use dental software at the dental practice might offer a great help to the forensic dentists because those programs come with a very rich key of explanation for the symbols and abbreviations, thus avoiding the tendency of the dentist to personalize his/her way of charting the dental treatment.

The most common dental procedures carried out at the dental practices on a daily basis such as fillings, prostheses and extraction use very similar symbols in different countries. However, the interpretation of abbreviations and dentist's personal notes presented the greatest challenge. The degree of difficulty increases even more when dealing with a foreign language.

Regarding tooth numbering, the results showed that the majority of dentists have been using FDI notation (~52%), followed by Palmer's Notation (~28%) and others (~14%); the results reveal a certain level of standardization in tooth numbering.

A compilation of the information gathered about abbreviations and symbols can be viewed at:

[www.internationaldentalcharts.org](http://www.internationaldentalcharts.org)

**Table 3:** The 45 countries followed by language spoken and tooth numbering system

45 Countries (language spoken)	Tooth numbering system
Argentina (Spanish), Australia (English), Brazil (Portuguese), Canada (English), Chile (Spanish), Colombia (Spanish), Germany (German), Greece (Greek), Indonesia (English, Indonesian), Israel (Hebrew), Italy (Italian), Malaysia (English), New Zealand (English), Norway (English), Peru (Spanish), Poland (Polish), Saudi Arabia (English), South Africa (English), Sweden (Swedish), Turkey (English), United Arab Emirates (English) and Venezuela (Spanish)	FDI
Barbados (English), China (Mandarin), Hungary (Hungarian), Japan (English), Jordan (English), Libya (English), Russia (English), Sri Lanka (English), Sudan (English), Syria (Arabic), Thailand (English) and Uganda (English)	Palmer
Costa Rica (Spanish), Finland (Finnish) and Lebanon (English), Croatia (Croatian)	No data
Denmark (Danish)	FDI, Palmer and Muhldreiter (I1, I2, C, P1, P2, M1, M2, M3)
France (French) and United Kingdom (English)	Haderup
India (English)	FDI and Palmer
Mexico (Spanish)	FDI, Zsigmondy
Pakistan (English)	FDI and Universal system 1
United States (English)	FDI and Universal System 1 Universal System 1

### DISCUSSION

It would be unlikely for any two individuals to have identical dental characteristics, but it is quite possible for two people to have similar data on their dental charts.<sup>23</sup> Therefore the written ante-mortem records should be carefully evaluated and compared to data obtained from radiographs.<sup>21</sup> Radiograph comparison increases the number of positive dental identifications<sup>24</sup> as the pattern, shapes and sizes of individual dental treatments present in one record are compared with similar traits and characteristics in other records.<sup>17</sup> Certainly dental radiographs are one of the most

desirable and reliable pieces of ante-mortem evidence, but they are not always available.<sup>25</sup>

It is always advisable to have communication between the private dentist and forensic dentist to clarify any discrepancies in the records.<sup>22</sup> In addition, another forensic dentist should ideally double-check the report.<sup>21</sup>

In the DVI scenario, one of the tasks of the ante-mortem team is to maintain an ante-mortem record system according to established protocols and to operate forensic dental software. However, the understanding of the received information is paramount and a prerequisite for carrying out those tasks.<sup>26</sup> If the various

**Table 4:** Examples of foreign dental terminologies, abbreviations and symbols

English dental terminology	Dental Terminology or abbreviations (country)	Symbols (country)
<b>Amalgam filling</b>	<i>a</i> (Finland, Sweden)	 (Saudi Arabia)
<b>Bridge</b>	<i>Puente fijo</i> (Chile)	 (Malaysia)
<b>Dental Crown</b>	<i>Corona dentale</i> (Italy)	 (Brazil)
<b>Fractured tooth</b>	<i>Fraktur</i> (Indonesia)	 (Australia)
<b>Full Gold Crown</b>	<i>KG - goldkrone</i> (Germany)	 (Indonesia)
<b>Post Crown</b>	<i>Καφίδα</i> (Greece)	 (Colombia)

professionals involved in victim identification cooperate, this also improves the interpretation of ante-mortem and post-mortem findings from foreign citizens among the disaster victims.<sup>27</sup> Moreover, INTERPOL recommends the use of English for all data entries, in a DVI situation.<sup>28</sup> Besides, the missing person's latest known dental status is to be listed. Start with the most recent entry in the written record, and work backwards; in this way, all previous treatment now covered by later treatment can be left out.<sup>29</sup> Furthermore, the dental data needs to be collated in the country of origin, by specialists trained in forensic dentistry because they are aware of the unique requirements of DVI charting and radiographs. Regrettably, dentists often hold back information as they may not realize its value.<sup>24</sup>

In fact, the international cooperation in forensic dentistry begins with the dentists in every country, faithfully recording details about the daily treatment they provide, thereby building up reliable dossiers of their entire patient's dentitions.<sup>30</sup>

### CONCLUSION

The new website is intended to be a source for different needs such as the: dental identification of foreign patients in mortuaries (when previous dental records are not written in English). In addition, the website is an aid to the dental teams working for the ante-mortem dental records section in DVI to decode international dental records. Furthermore, it is always advisable to enlist the help of a dentist from the local country to make the interpretation or to give a second opinion to strengthen the value of the report

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