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FORENSIC DENTISTRY

DENTAL RECORDS REQUIREMENTS FOR
THE PAPUA NEW GUINEA DEFENCE FORCE

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A THESIS SUBMITTED IN PARTIAL
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>(ii)</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>(iii)</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>(vi)</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>(vii)</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. HISTORY OF FORENSIC DENTISTRY</td>
<td>7</td>
</tr>
<tr>
<td>3. PAPUA NEW GUINEA AND ITS LEGAL SYSTEM</td>
<td>10</td>
</tr>
<tr>
<td>3.1 GEOGRAPHY AND ECONOMY</td>
<td></td>
</tr>
<tr>
<td>3.1.1 Geography</td>
<td></td>
</tr>
<tr>
<td>3.1.2 Economy</td>
<td></td>
</tr>
<tr>
<td>3.2 PAPUA NEW GUINEA DEFENCE FORCE</td>
<td>11</td>
</tr>
<tr>
<td>3.2.1 Development</td>
<td></td>
</tr>
<tr>
<td>3.2.2 Identification and Records</td>
<td></td>
</tr>
<tr>
<td>3.3 THE ROLE OF FORENSIC DENTISTRY IN THE PNGDF</td>
<td>15</td>
</tr>
<tr>
<td>3.3.1 Need for Identification</td>
<td></td>
</tr>
<tr>
<td>3.3.2 Positive Identification</td>
<td></td>
</tr>
<tr>
<td>3.3.3 Identification Team</td>
<td></td>
</tr>
<tr>
<td>3.4 THE PAPUA NEW GUINEA LEGAL SYSTEM</td>
<td>20</td>
</tr>
<tr>
<td>3.4.1 The Village Court</td>
<td></td>
</tr>
<tr>
<td>3.4.2 The Local or District Courts</td>
<td></td>
</tr>
<tr>
<td>3.4.3 The National Court</td>
<td></td>
</tr>
<tr>
<td>3.4.4 The Court of Petty Session</td>
<td></td>
</tr>
<tr>
<td>3.5 CORONERS IN PAPUA NEW GUINEA</td>
<td>22</td>
</tr>
<tr>
<td>3.5.1 Appointment</td>
<td></td>
</tr>
<tr>
<td>3.5.2 Powers</td>
<td></td>
</tr>
<tr>
<td>3.5.3 Jurisdiction</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Page Numbers</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>3.5.4 Procedures of Inquests of Death</td>
<td>24</td>
</tr>
<tr>
<td>3.5.5 View of Body</td>
<td>25</td>
</tr>
<tr>
<td>3.5.6 Postmortem Examinations</td>
<td>26</td>
</tr>
<tr>
<td>3.5.7 Suicides</td>
<td>26</td>
</tr>
<tr>
<td>4. FORENSIC IDENTIFICATION</td>
<td>27</td>
</tr>
<tr>
<td>4.1 IDENTIFICATION BY VISUAL RECOGNITION AND FROM PERSONAL EFFECTS</td>
<td>27</td>
</tr>
<tr>
<td>4.1.1 Visual Recognition</td>
<td>27</td>
</tr>
<tr>
<td>4.1.2 Personal Effects</td>
<td>27</td>
</tr>
<tr>
<td>4.2 SCIENTIFIC METHODS OF IDENTIFICATION</td>
<td>29</td>
</tr>
<tr>
<td>4.2.1 Fingerprints</td>
<td>29</td>
</tr>
<tr>
<td>4.2.2 Human Dentition</td>
<td>29</td>
</tr>
<tr>
<td>4.2.3 Skeletal Remains</td>
<td>29</td>
</tr>
<tr>
<td>4.2.4 Radiographs</td>
<td>29</td>
</tr>
<tr>
<td>4.2.5 Blood Grouping</td>
<td>29</td>
</tr>
<tr>
<td>4.2.6 Hair</td>
<td>29</td>
</tr>
<tr>
<td>4.3 IDENTIFICATION BY EXCLUSION</td>
<td>34</td>
</tr>
<tr>
<td>4.4 OTHER TYPES OF FORENSIC EXAMINATION</td>
<td>35</td>
</tr>
<tr>
<td>5. DENTAL EXAMINATION</td>
<td>37</td>
</tr>
<tr>
<td>5.1 DENTAL IDENTIFICATION PROCEDURES</td>
<td>41</td>
</tr>
<tr>
<td>5.1.1 Postmortem Examination</td>
<td>41</td>
</tr>
<tr>
<td>5.1.2 Antemortem Records</td>
<td>41</td>
</tr>
<tr>
<td>5.1.3 Comparison of Antemortem and Postmortem Records</td>
<td>41</td>
</tr>
<tr>
<td>5.1.4 Reports</td>
<td>41</td>
</tr>
<tr>
<td>5.2 ANTEMORTEM DENTAL RECORDS</td>
<td>47</td>
</tr>
<tr>
<td>5.2.1 Antemortem Records</td>
<td>47</td>
</tr>
<tr>
<td>5.2.2 Types of Antemortem Charts</td>
<td>47</td>
</tr>
<tr>
<td>6. THE METHOD OF RECORDING AND STORAGE OF DENTAL DATA IN THE PAPUA NEW GUINEA DEFENCE FORCE</td>
<td>49</td>
</tr>
<tr>
<td>6.1 DENTAL RECORDS</td>
<td>49</td>
</tr>
<tr>
<td>6.2 THE DENTAL FORM</td>
<td>50</td>
</tr>
</tbody>
</table>
6.3 DENTAL EXAMINATION
   6.3.1 Initial Examination
   6.3.2 Annual Examination
   6.3.3 Priority Examination
   6.3.4 Final Examination

6.4 RECORDING OF DENTAL EXAMINATION AND TREATMENT 56

6.5 COMPLETION OF EXAMINATION OR TREATMENT 59

6.6 TOOTH NUMBERING SYSTEM

6.7 MAINTENANCE, CUSTODY AND TRANSMISSION OF DENTAL DOCUMENT. 59

7. SUMMARY 61

REFERENCES 63

APPENDICES 65
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charred body. Recognisable features have been destroyed.</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Charred Head. Visible features eliminated</td>
<td>3</td>
</tr>
<tr>
<td>3 &amp; 4</td>
<td>Scalp, portion of head and part of left hand in air disaster.</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>Unrecognisable features of a drowned seaman.</td>
<td>28</td>
</tr>
<tr>
<td>6 &amp; 7</td>
<td>Abscess perforations (a) from left Mandibular 2nd premolar (b) and Radiograph showing the abscess (arrow).</td>
<td>33</td>
</tr>
<tr>
<td>8 &amp; 9</td>
<td>Tooth development and eruption charts.</td>
<td>38 &amp; 39</td>
</tr>
<tr>
<td>10</td>
<td>Dissection of jaw structure showing mix dentition.</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>Example of portmortem examination chart.</td>
<td>42</td>
</tr>
<tr>
<td>12</td>
<td>An example of chart used for dental findings.</td>
<td>43</td>
</tr>
<tr>
<td>13</td>
<td>An example of chart used in re-arranging dental data.</td>
<td>44</td>
</tr>
<tr>
<td>14</td>
<td>Form HS14 introduced in October, 1973</td>
<td>51</td>
</tr>
<tr>
<td>15</td>
<td>Form HS14A Designed chart</td>
<td>52</td>
</tr>
<tr>
<td>16</td>
<td>Form HS14B Designed construction chart</td>
<td>53</td>
</tr>
</tbody>
</table>
**LIST OF APPENDICES**

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>Dental Numbering System</td>
<td>65</td>
</tr>
<tr>
<td>Appendix B</td>
<td>FDI Numbering System</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Common Abbreviations</td>
<td></td>
</tr>
<tr>
<td>Appendix C</td>
<td>Examples of Common Dental Charts</td>
<td>70</td>
</tr>
</tbody>
</table>

1. Chart used by some dental practices.

2. Chart used by Australian Defence Forces

3. Chart used by the Public Health Department in Papua New Guinea.
1. INTRODUCTION

This thesis aims at reviewing available literature on forensic dentistry and formulation of a suitable system of recording and storage of dental data for forensic purposes in the Papua New Guinea Defence Force. There is no set standard at present. This thesis will aim at designing a set standard so that a uniform method can be used throughout the PNGDF.

The need for accurate identification of a person is becoming very important in this century because of the social and legal responsibility placed on society. Individuals having different characteristics contribute either individually or as a group to the society in various ways. The society is in turn responsible for their security and wellbeing. If an individual goes missing, the society is responsible to find him and return him to his community. If he is found dead, he should be identified, the cause of death, time of death is arrived at, and if it is murder, the person or persons responsible are identified and punished. The need for accurate identification is mandatory for completeness of official records, notification of next of kin, settlement of estate and insurance.

The identification of persons by their dentition has been recorded throughout history in scattered incidents, but this has become very important since the increase in
international traffic and movements of individuals from one community to another, with a measurable risk of accidents. Major accidents and disasters coupled with the development of complex social and legal systems, makes it essential for positive identification of individuals. Common means of identification is usually destroyed in major disasters and the only means available may be the dentitions of victims, e.g. aircraft accidents which usually catch fire and burn victims. (Figures 1 & 2).

The use of medical knowledge in scientific investigations in the interest of justice is not a new concept. Dental knowledge however was not used extensively until recently. Forensic dentistry, a branch of forensic medicine, is defined by Keiser-Neilsen (1980) as, "That branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence and with proper evaluation and presentation of dental findings." This field involves all specialities in dentistry. Dentists involved in forensic investigations may need to seek advice from dentists in other fields of dentistry.

Forensic dentistry has been divided into three major fields of activities by Cameron, J.M. and Sims, B.G. (1974). These are civil, criminal and research.
Figure 1. Charred body. Recognisable features have been destroyed. (Irvin M. Sopher 1976 figure 19)

Figure 2. Charred Head. Visible features eliminated. (Werner U. Spitz & Russel S. Fisher (1973) figure iv-3)
(a) Civil. This classification includes:

1. Malpractice and all aspects which may lead to criminal charges in the form of fraud;

2. Neglect, where damages may be sought;

3. Identification of a dead person where death is due to suspicious circumstances;

4. Identification of a living person where the person has lost his memory;

5. Identification of victims of major disasters.

(b) Criminal includes identification of:

1. Living and dead person from their dentition.

2. Bite marks on victims and assailant and on foodstuff.

(c) Research includes;

1. Academic and courses;

2. Postgraduate tuition.
The identification process is divided into three main phases which include:

1. The examination and recording of all essential details including dentition:

2. Collecting information of a similar characteristic to that of missing person.

3. Matching the collected data.

This task is usually made difficult in major disasters because of lack of records and the different methods used throughout the world in recording details.

Papua New Guinea is one of the most difficult countries to fly in because of its high and rugged terrain. It is not surprising that years after the Second World War, lost aircraft with their passengers are still being found, sometimes only a few thousand metres from a village. The main mode of transportation even today is by air. The Papua New Guinea Defence Force is one of the main users of air transport.

In 1972 an Australian Caribu aircraft crashed, killing 20 of 25 school cadets, two pilots and an Army Captain. Again in 1981 a PNGDF Nomad aircraft crashed after inserting troops, killing both the pilots. In both cases, fire destroyed the front part of the aircraft and the pilots
were burnt. In the first accident, the two pilots and the army captain were identified from their dentition. For social and legal reasons, a standard method of dental recording should be established. This would help in easier understanding of details should the need arise to carry out a mass identification.

This thesis will review the following topics as well as formulating a standard method for recording and storage of dental information in the PNGDF.

(a) The history of forensic dentistry.
(b) Papua New Guinea and its legal system
(c) Forensic examination
(d) Dental identification
(e) Method of recording and storage of dental data for the PNGDF.
2. HISTORY OF FORENSIC DENTISTRY

The use of dental information to identify people has been reported throughout history. Examples are reported in the Dental Clinics of North America (Luntz 1977). One story related that shortly after her marriage to Claudius, the Emperor of Rome, Agrippina began planning to secure her position because she feared that the rich divorcee Lollia Paulina might still be a rival to her husband. She persuaded Claudius to banish Paulina, but not satisfied with this, she sent her own soldiers to kill Paulina. After killing her, Paulina's head was brought back. Agrippina did not recognise the face, so parting the lips, she was able to distinguish certain dental characteristics that Paulina was known to have.

In the Fifteenth Century in America, Paul Revere, a copper-smith and a silversmith, constructed a silver-wire bridge for his close friend Dr. Joseph Warren. During the British American War in 1775, Dr. Warren was killed by the British and buried in an unmarked grave. Ten months later, the British withdrew and Warren's body was dug up along with other bodies. His body was identified by Paul Revere from the silver-wire bridge that Paul had earlier constructed. Warren's body was later re-buried in a proper cemetery. (References from this section on History of Forensic Dentistry are taken from Luntz (1977) and Pert,(1980)).
The interest in forensic dentistry was heightened in the nineteenth century but became relatively dormant until the 1960s. The increase in interest is due to the large numbers of people involved in major disasters. Now books are written by such authors as Gustafson, Furahata, Keiser - Neilsen, Warren Harvey and so on, on forensic dentistry. A number of societies and associations have also been formed in this field. Some of these societies and associations are:

- The American Society of Forensic Odontology,
- The American Academy of Forensic Science,
- The Canadian Society of Forensic Science,
- The Scandinavian Society for Forensic Science,
- The International Society for Forensic Odonto-Stomatology.

These societies have been formed to bring together dentists who are interested in the subject. Formal courses are now offered in some Universities. One of the first institutions to offer such a course is the United States Armed Forces Institute of Pathology at the Walter Reed Army Medical Centre in Washington D.C. Legal institutions, investigation agencies and the police are becoming aware of the part forensic dentistry can play in investigations and are calling on dentists for help. A good example of forensic dentistry being used was shown in the Mt. Erebus air disaster in 1979 in which an Air New Zealand DC10 crashed, killing 257 aircrew and passengers.
Out of 214 Positively identified bodies, 142 were mainly identified by dental means by a group of dentists who were called upon to help in the identification.
3. PAPUA NEW GUINEA AND ITS LEGAL SYSTEM

3.1 GEOGRAPHY AND ECONOMY

3.1.1 Geography

Papua New Guinea gained its independence from Australia on the 16 September 1975. It is made up of the eastern part of the New Guinea island. The western segment is occupied by Indonesia. The people are mainly Melanesians. There are however other ethnic groups from Asia, Europe, America and Australia. The population is over three and a half million with over 10,000 tribes and 700 dialects. Motu, pidgin english and english are the three main languages of communication. Geographically, the country is very rugged, the highest peak being about 14,700 feet and is snow capped during winter in the Southern Hemisphere. The main mode of transportation is by air. The rugged terrain and the fast changing weather patterns makes flying conditions difficult at times. Many new pilots have been caught in such situations and many have had accidents which usually resulted in death.

3.1.2 Economy:

Economically Papua New Guinea depends on its minerals, timber fish, cash crops and from Australian aid which amounted to about A$1,000 million in 1980. The people are now more dependent on cash rather than exchange of one
local product from another as was done in the past. It is therefore not unusual for people to claim cash compensation for land, accidents and for death of relatives. Claims especially for land acquired with axes, knives, clothes etc. in the past, are made to the government for large sums of money since independence. This is costing the government millions of kina each year. The Papua New Guinea Defence Force is not exempted from claims such as these. Relatives are claiming compensation for Servicemen who die while in the PNGDF. Businesses and other employers are not taking out insurance policies in case of such claims.

3.2 PAPUA NEW GUINEA DEFENCE FORCE

3.2.1 Development:

The Papua New Guinea Defence Force is a Combined Force of a Land Sea and Air Elements. The force expanded from the (PIB) Papuan Infantry Battalion and (NGIB) New Guinea Infantry Battalion. These two battalions were formed under Australian Commanders to fight against the invading Japanese. They were disbanded after the War and reformed as (PIR) Pacific Islands Regiment in 1952. The Force expanded and became known as the Papua New Guinea Command under the Australian Defence Force. At Independence it became the Papua New Guinea Defence Force (PNGDF). The sea Element was part of the Australian Navy. The Air Element was formed in the early 1970s. The Papua New
Guinea Defence Act provided that these three elements join together and come under one Commander. Each element has a Director who is responsible through the Chief of Staff to the Commander. The Act also provided that a civilian be appointed as Secretary of Defence by the Minister for Defence. He has a similar status as the Military Commander on defence matters. Both the Commander and the Secretary are members of the Defence Council. Under the Act, the Force is allowed to make its own policies and regulations and these must be accepted by the Defence Council before being implemented. It is under these arrangements that dependants of Servicemen are given free health care and allowed limited use of military transportation.

3.2.2 Identification and Records:

The Papua New Guinea Defence Force, like most military forces, issues servicemen regimental numbers which are inscribed on two metal discs about 3cm in diameter. The discs are attached to strings and hung around the neck. The blood group and religion of servicemen are also inscribed on these discs. In addition, the following records are kept and can be used in identification:

1. The AB-83 record of Service. It contains particulars such as regimental number, photograph of a service-man, date of birth, religion, blood group, birthmarks or scars and the next of kin and their address. Other
relevant information is added to the AB-83 during the period of service of the soldier. Examples of these informations are: dates of promotion, awards, pay increment, postings, courses attended etc.

2. Personal file. This contains detail information on data found in the AB-83.

3. Medical and dental records, including radiographs.

4. Identification Cards. This has the serviceman's photograph, date of birth and signature.

All the above records are always produced in duplicates and a copy is kept in central records office.

Dependents are issued with identification cards and a copy is usually kept. Medical and dental records are also kept at the Medical Centre and copies are kept at central records office with the servicemen's duplicate records.

These documents are sufficient and can be used for identification purposes. They are however not reliable if visible details are destroyed and the metal discs are lost. A good example of this was shown by this incident in 1981: An unconscious soldier with cerebral
malaria was admitted to the Defence Force hospital where he regained consciousness. He was however slightly disarray and was kept under observation but was allowed to wander around the hospital grounds. He went missing one afternoon and a search was mounted but no trace of him was found. Four days later a body was found immersed in seawater about three kilometres from where the soldier was last seen. A shirt and a pyjama cord were found on the body. The facial features, the palms and other identification marks were all destroyed from decomposition. After a few days of conflicting identification, dental records of the missing soldier were used to identify the body. An oral examination was carried out and the following found:

1. An occlusal silver amalgam on the maxillary left first molar.

2. A dark brown stain on the mesial surface of the maxillary left central incisor.

3. All 32 teeth were present.

The following was recorded on the dental card of the missing soldier:

1. All 32 teeth had erupted and were present.

2. An occlusal amalgam filling was put in the maxillary left first molar.
3. A mesial cavity was recorded on the maxillary left central incisor.

When the two records were compared, it was concluded that the dark brown stain on the mesial of the maxillary left central incisor may have been mistaken for a cavity. This conclusion was accepted by the coroner and the other two recorded information being the same, it was concluded that the body was that of the missing soldier. A death certificate was then issued.

(Manual of Personnel Administration Papua New Guinea Defence Force, Paragraphs 2-1 to 2-4 and 167-1 to 167-3)

3.3 THE ROLE OF FORENSIC DENTISTRY IN THE PNGDF

3.3.1 Need for Identification

It may be argued that in a major disaster such as an aircraft accident, the list of victims is sufficient for identification and mass burial. This is however not humane and for the following reasons, cannot be done in Papua New Guinea:

(a) The law required that a body must be identified whenever possible, the cause of death established and a death certificate issued, before that body can be disposed of.
(b) Papua New Guineans have very strict customs regarding the death of one of their tribesmen. Various ceremonies are performed before the dead are buried. They would react very strongly against authorities if victims of a disaster are not identified and buried in a mass grave. Identification of an individual helps relatives get over their grief and makes a proper burial more meaningful to them.

(c) In major disasters, forensic identification helps identify causes of the disasters, improve methods of safety and reduce the risk of accidents.

(d) In aircraft accidents, forensic identification helps in:

1. if a person other than the one whose name appears on the ticket is travelling;

2. if there was a stowaway or a highjacker on board;

3. giving the state of health of the aircrew at the time of accident.

4. Patterns of injuries in different parts of the aircraft could give some ideas to the cause of the accident.
5. It could help in alteration of the aircraft, its safety equipment and emergency exists and improve safety in the aircraft.

3.3.2 Positive Identification:

Positive identification of a large number of victims of a major disaster presents a difficult problem and is mainly dictated by the nature of the disaster. It may be that victims are well preserved but nothing is known about them or they may be torn apart and parts of their bodies scattered over a wide area. They may be burnt beyond recognition. It is not unusual that when investigators arrive at the scene of a disaster, they would find that victim's bodies have already been moved. This is done with more haste than thought and valuable informations which may make identification easier are lost. (Figures 3 & 4).

3.3.3 Identification Team:

It would make the task of mass identification easier if an organisation is formed and a team of investigators trained to carry out investigations and identify victims. Untrained investigators may be put off by the usual gruesome sight of victims and tend to miss important evidence that may be present at the site. Visual and standard method of identification used by many police forces may not be useful in a mass disaster because recognisable features may be destroyed especially if
Figures 3 & 4. Scalp, portion of head and part of left hand in air disaster. (Werner U. Spitz & Russel S. Fisher (1973) figures xvi.5 xvi.6)
fire is involved. A trained team consisting of the following persons, in the Papua New Guinea Defence Force, would make the task of identifying victims easier.

1. The co-ordinator – a senior staff officer.

2. A provost officer and an NCO, a civil police officer and one of his NCO.

3. The Force Photographer.

4. An officer from Air Operation and an officer from the Civil aviation investigating team.

5. A medical and a dental officer.

6. At least two medical and two dental assistants.

7. A Pathologist from the main hospital.

8. An investigator from the coroners office

This team should train regularly on the process of recovering victims of air or other disasters and carrying out various investigations and identifications. The medical and dental teams should concentrate on recovering and identifying victims. Since the Defence Force allows other people other than soldiers to travel on its vehicles and its aircraft, it will be useful to have such a team available and trained, in case a disaster occurs. Such a team can also help civil authorities in major disasters if the Defence Force is requested to help. The role,
therefore, of a PNGDF forensic team will be to:

1. Train regularly on the subject of forensic identification.

2. Carry out forensic identification on soldiers, dependants and civilians working for the Defence Force if required.

3. Advice on improvement of safety methods to reduce accidents and improve survival chances of victims.

4. Help civilian authorities in forensic investigation if requested to.

The dental team would concentrate on recording and storing of dental information, charting and comparing dental data. of forensic nature to improve skills on dental identification.


3.4 THE PAPUA NEW GUINEA LEGAL SYSTEM

At Independence, Papua New Guinea adopted the Westminster System of Government and joined the Commonwealth. An Act was also passed in the House of Assembly adopting most of the legislation made by the Australian Administration before independence. Most of the laws are therefore similar
to Australian and English laws. The only difference in some cases is the fact that some customary laws are taken into account where a judgement is passed. There are at least four types of court systems:

3.4.1. **The Village Court**: A Village Court Magistrate, who is usually from the village area, runs this court. This court usually deals with minor matters which may involve the Breaking of customary laws.

3.4.2 **The Local or District Courts**: A magistrate usually presides over this court. It deals with minor criminal and civil offences.

3.4.3 **The National Court**: It is usually presided over by a judge. It deals with major Criminal and Civil cases and appeals from the lower courts.

3.4.4 **The Court of Petty Sessions**: The court of appeal to the Queens Council.

3.4.5 The Government has provided the public with lawyers who are available as either Public Prosecutors or Public Solicitors who are available to the public if they cannot afford private lawyers.

3.5 **CORONERS IN PAPUA NEW GUINEA**

3.5.1 **Appointment:**

In Papua New Guinea, a coroner is appointed by the Judicial and Legal Services Commission. In theory the Commission can appoint any person of any profession (calling) to be a coroner. District Officers and Justices are by virtue of their offices, coroners and have jurisdiction, power and authority as coroners throughout the country. A coroner who is a medical practitioner is not competent or compellable to hold an inquest on the body of a person whom he attended professionally at or immediately before his death or during his last illness.

5.3.2 **Powers:**

A coroner has all the jurisdiction, power and authority that belongs to the office of a coroner in England. Furthermore, for the purposes of an inquest, a coroner has all the powers conferred on a Magistrate by the District Courts Act in respect to the preliminary hearing of an indictable offence.

3.5.3 **Jurisdiction:**

A coroner has jurisdiction to enquire into the manner and cause of death of a person who:

(a) has been killed;
(b) has drowned;

(c) has died a sudden death of which the cause is unknown;

(d) has died under suspicious or unusual circumstances;

(e) died while under an anaesthetic in the course of a medical, surgical or dental operation or an operation of a like manner;

(f) died, but no certificate of a medical practitioner has been given as to the cause of the death;

(g) died within a year and a day after the date of an accident where the cause of the death is directly attributable to the accident;

(h) died in a corrective institution, rural lock-up or police lock-up, or while in a prison or in custody;

(i) died in a mental hospital or other institution under such circumstances as to require an inquest under the CORONERS ACT or any other Parliamentary enactment;

(j) died in such circumstances that, in the opinion of the Principle Legal Adviser, the cause of death and the circumstances of the death should be more clearly and definitely ascertained. The Principle Legal Adviser is usually the Secretary for Justice; or
(k) died, not having been attended by a medical practitioner at any time within three months before his death.

3.5.4 Procedures at Inquests of Death:

Unless he is a medical practitioner, it is not the job of the coroner to gather evidence of a forensic nature. His job is merely to gather evidence from as many sources as possible and make his findings based on the evidence he has complied. To achieve that aim, the coroner is empowered to examine on oath all persons who he thinks fit to examine or who tender their evidence or who in his opinion are able to give relevant evidence respecting the facts concerning the death. After he has heard all the evidence, he gives his decision or findings and certify in writing (in the prescribed form) setting forth particulars like the identity of the deceased, how, when and where the deceased came by his death and the person (if any) suspected or accused of having caused the death by wilful murder, murder or manslaughter.

3.5.5 View of Body:

It is not necessary for the coroner, in an inquest of death, to view the body of the deceased unless he thinks it advisable. He merely summons witnesses, for instance, a medical practitioner who last attended to the deceased person.
3.5.6 Post-Mortem Examinations:

(a) Where a coroner considers advisable to have a post-mortem examination made of the body of a person who has died and the cause of death is unknown or in doubt or a body respecting which a doubt exists as to whether it is that of a still-born child, the coroner may, before the extermination of the inquest, direct a medical practitioner to make a post-mortem examination of the body of the deceased person, with or without an analysis of the contents of the stomach, intestines or other organs.

(b) Where it appears to the coroner that the death of the deceased person was or might have been caused partly or wholly by improper treatment by a medical practitioner or other person, the medical practitioner or the other person must not be allowed to perform or assist at the post-mortem examination or analysis.

(c) If the results of a post-mortem examination carried out by a medical practitioner are not satisfactory to the coroner, he may call in another medical practitioner to conduct a post-mortem examination.
3.5.6 Suicides:

In Papua New Guinea, the verdict of felo de se (one who commits suicide) is abolished. Therefore a coroner no longer has the power to:

(a) forbid the rites of Christian burials at the internment of a person who has committed suicide or died by his own act; and

(b) forfeit or escheat to the State of Real or Personal property simply because he committed suicide or died by his own act.

4. **FORENSIC IDENTIFICATION**

There are various methods used by investigators to establish identity of persons or of unknown bodies. The reliability of each method varies upon the method used and depends on the physical condition of the body found. If the body has decomposed or is charred from a fire, identification may be made difficult. It is however possible to corroborate data from several methods to establish an identity.


4.1 **IDENTIFICATION BY VISUAL RECOGNITION AND FROM PERSONAL EFFECTS**

4.1.1 **Visual Recognition:**

The most common means of identification is the visual recognition of facial features, scars or tattoos by friends and relatives. (Photographs may also be used to identify recognisable features). This method is usually used in the case of recent deaths where recognisable features are not destroyed. Such deaths may be from natural deaths, accidents or as a result of homicides. It is not always a reliable method as cases of mis-identification have been reported to have occurred where visual recognition was used.
Figure 5. Unrecognisable features of a drowned seaman.
(Werner U. Spitz & Russel S. Fisher 1973 figure 24)
4.1.2 **Personal Effects:**

Personal effects such as clothing, jewellery, watches and documents do help in establishing identities. These articles decay at a slower rate than human tissues and may remain well preserved in the midst of skeletonised remains. Even in cases of marked incineration of a body, it is not unusual to find tattered clothing, wallets, jewellery, rings, keys and watches which may render information towards a positive identification which, later, can be verified by a dental examination. In cases of homicide and other criminal activities, these articles can be switched and may not belong to the body found. In mass disasters, these articles found on individuals can narrow the field of investigation to those who are known to have possessed such articles, thereby separating them from other groups of individuals. Positive identification can be established later from fingerprints or from dentitions. (Irvin M. Sopher 1976, p.35-46).

4.2 **SCIENTIFIC METHODS OF IDENTIFICATION**

4.2.1 **Fingerprints:**

The most widely used scientific method of establishing identification is the fingerprint method. It has been established that no two people have the same fingerprints. The (FBI) Federal Bureau of Investigation Fingerprint Division in Washington D.C. USA, has currently classified
prints on file of about 84 million individuals living in the United States. This method however has its disadvantages. These are:

(a) Lack of fingerprint record of an individual for comparison;

(b) Lack of sufficient post-mortem fingerprints tissue. The latter may be due to decomposition or charring of the fingertips.

Contraction of muscles during death results in a clenched fist. As a result, finger tissues may be intact and suitable for prints. It is therefore important to check for this possibility during postmortem examination. Postmortem prints of individuals can be easily checked with latent prints found on articles and domestic objects in homes or offices.

4.2.2. Human Dentition:

The human dentition which is the site of prevalent and chronic breakdwon during life outlast all other body tissue after death. Dental identification rest upon the innumerable combinations of restorations, pathoses, missing and carious teeth in a possible 32 teeth with 160 visible surfaces in an oral examination of an adult. In addition radiographs showing anatomical and pathological changes and root fillings further enhance dental identification. The value of dental identification rest on the availability of
ante-mortem dental records for comparison with post-mortem records. Arm forces have recognised the value of dental identification and have stressed the importance of up to date accurate ante-mortem dental records. In civilian life, some companies employing personnel in high-risk accident prone jobs, maintain meticulous dental records including colour photographs of the dental structure of their employees. If ante-mortem dental records are available and a post-mortem record is obtained, positive identification can be established in a matter of hours.

4.2.3 **Skeletal Remains:**

Given the right environmental conditions of heat and moisture, a body can decompose rapidly and be skeletonised within two months. Insects and animal activities can also increase the decomposition process. Skeletal remains contain an abundance of information which, when studied, can lead to a reliable determination of race, sex, age and the possible status of the individual in life. In addition, information on the estimation of the time of death can be established also. Pathology identified within the bone can provide evidence of a disease or of old injuries which can be compared with ante-mortem medical or dental records and radiographs. Figures 6 and 7. (Werner U. Spitz and Russell S. Fisher 1973 p.68-69). Skeletal remains can be reconstructed by means of wires and glues to give an estimate height of the subject during life and may also reveal to investigators the cause of
death. e.g. fractured skull or bullet holes. It is therefore important that all skeletal remains found, must be delivered safely to the pathologist responsible for the investigation.

4.2.4 Radiographs:

Medical and dental radiographs taken during postmortem examination may establish the cause and manner of death and also produce valuable data relevant to identification. The body Viscera also provides clues of the age of individuals. Even in severe charring of the exterior, it is usual that the internal organs are relatively unaffected and are quite suitable for studies by the pathologist. The comparison of pathological changes found during postmortem examination and antemortem radiographs may serve to corroborate or dispute positive identity. Figures 6 & 7. (De Vore T. Dune Jan 1977. p.69-83).

4.2.5 Blood Grouping:

Postmortem blood grouping of human tissues represent another specific source of scientific information which can be utilised in comparison procedures. A known postmortem blood grouping for an individual serves to narrow the range of possible identities. The inability to obtain whole blood postmortem does not eliminate the use of serology in identification. Bone marrow, teeth and tissues may still have detectable blood group antigens and the possibility should not be discarded.
Figures 6 & 7. Abscess perforations (a) from left Mandibular 2nd premolar (b) and Radiograph showing the abscess (arrow). Werner U. Spitz & Russel S. Fisher 1973. figures iv.1 & 2).
4.2.6 **Hair:**

The microscopic examination of body hair enables the pathologist to classify the race of individuals and narrow the range of possibility of identity. The scalp hair decays at a slower rate than the soft tissues upon decomposition. The hair can substantiate the racial determination suggested by the examination of the skeleton.


4.3 **IDENTIFICATION BY EXCLUSION**

This method establishes identity by comparison of post-mortem data with known antemortem data pertaining to other individuals. If in an aircraft accident the manifest shows only one female among the passengers and crew, she can be excluded from the others by means of sex identification. In other cases, if the number of children, their sexes and ages are known, they can be grouped and excluded from other bodies. Dental examination can then be used to establish positive identification of each individual. The basis of this method consists of the correlation of established antemortem facts with nonspecific postmortem data.

4.4 OTHER TYPES OF FORENSIC EXAMINATION

Other types of forensic examination can help establish facts which may help to determine the causes and manner of deaths. e.g. blows, gunshot or poisons. These methods can also help determine whether a person was killed before his body was disposed and the type of weapon used to inflict death. Other areas that forensic examinations is used to assist in investigations are:

(a) Illegal Abortions: The expulsion of previable ovum, viable or live fetus for non therapeutic reasons would constitute a criminal abortion. Abortions can be induced physically, chemically and operatively. Complications such as hemorrhage pulmonary thromboembolism can cause death and as a result a forensic expert in medicine may be called to carry out an examination to determine the cause of death.

(b) Child Neglect and Cruelty: The maltreatment of children has been reported as far back as 400 BC. This mistreatment has been rationalized by virtually every justification known to man, including religious beliefs and practices, discipline and education and to a large degree, by economic gain. In recent times, newspapers accounts have described in details instances of closetsing of children in lightless rooms for periods of weeks and months,
suspension of children by their wrist from walls, prolong exposure to extreme temperatures and severe beatings. These may result in deformity, internal injuries and deaths.

(c) Assaults: The result of assaults such as rape or manhandling is severe psychological or traumatic injury and death. Forensic examinations may help courts to award compensation or find the cause of death and the person responsible for this crime.

(d) Negligence in the Cause of Duty: Negligence in a job usually causes failure and hardship to other persons. Negligence in flying, in industry or in medicine and dentistry may result in the loss of life. Forensic examinations can determine the causes and the forms of negligence.

Dentists should make themselves aware of the various forensic fields and be able to converse not only in their field, but on the fields of other team members as well and be accepted as a full member of an investigating team.

5. **DENTAL EXAMINATION**

The exclusion method of identification is usually used prior to dental examinations. This method is usually employed in mass disaster to group victims into groups such as males and females and age groups to narrow the field of investigation. Dental examination is then used to establish positive identification. The use of teeth in establishing identity is based on the principle of comparison. Positive identification is possible because each human tooth has five clinically visible tooth surface and as many as 32 teeth which may erupt into a person's mouth giving a total of 160 surfaces. The number of possible combinations of decayed and restored surfaces, missing and extracted teeth, rotated or malaligned teeth, supernumerary teeth, tori and other body defects and prosthetic appliances gives a person a uniqueness of his own. If radiographs are available, then the possible combinations of pathological features, root fillings, periodontal bone loss, impacted teeth and retained roots gives an individual an enormous amount of data which can be used to identify him positively. Tooth development and eruption patterns gives one of the most accurate methods of age determination. Figures 8, 9 and 10.

Figure 8. Tooth development and eruption charts. (Irvin M. Sopher 1976. figures 56 & 57)
Figure 9. Tooth development and eruption charts. (Irvin M. Sopher 1976. figures 56 & 57)
Figure 10. Dissection of jaw structure showing mix dentition.
(Irvin M. Sopher, 1976. figure 55).
The use of developmental and eruption charts with intra-oral and extra-oral radiographs can determine an approximate age of a person. The uniqueness of dentition is such that no two individuals can have the same characteristics. If a victim is bitten or bite marks are left on foodstuff, impression of these can be taken and matched with those of suspected assailants or thieves and the person responsible can be identified.


5.1 **DENTAL IDENTIFICATION PROCEDURES**

The dental identification procedures, based on the principle of comparison is carried out in the following stages:

5.1.1 **Postmortem Examination:**

It is essential to record every detail found on an unknown body. Radiographs and models are also taken and kept safely. The dental form used should be labelled "Unknown Person". Figures 11, 12 and 13 shows forms which are used in America (S. Keiser - Nielsen, 1980 p.9-16). It is essential to use common notation and numbering system so that it can be easily understood by other dentists. The F.D.I. Numbering system adopted by W.H.O. is used and understood by many dentists. It should be used where possible. Appendix A shows the
Figure 11. Example of Postmortem examination chart.
Figure 12. Example of Chart used for dental findings.
Figure 13. An example of chart used in re-arranging dental data. (Figures 11, 12 & 13)
different notation and numbering system used in different countries. Appendix B shows the F.D.I. System. Photographs of the dentition should also be taken during the post-mortem examination and also attached to the dental record. It may also be used for comparison with other anti-mortem photographs. Appendix B also shows some common notations used.

For legal purposes, the name of authorities or agencies requesting investigation, the date, the recovery number of the unknown body, the time the postmortem examination took place should all be recorded and signed. The record then is stored away until ante-mortem records are brought in for comparison.

5.1.2 Antemortem Records:

The dental expert involved in the investigation will require investigators or police to collect ante-mortem dental records of all victims on the manifest of an aircraft involved in an accident. If it is an unknown body, the dental expert should ask for ante-mortem records of missing persons. When brought in, the data of these records should be re-arranged on similar forms as those used in postmortem examination. This will bring out similarities which can be easily picked up and compared with postmortem records. The expert may need to contact his colleagues for clarification of notations and other details or obtain other materials to add to the information.
he needs for comparison. Intra-oral and extra-oral radiographs and old models can provide valuable information.

5.1.3 Comparison of Antemortem and Postmortem Records:

After all antemortem records are re-arranged and all additional information recorded, postmortem records are brought out and compared. Similar records are grouped then detail comparison is carried out with individual records until a conclusion is arrived at. Where possible, this should be done independently by other dentists available so that there can be no bias on the identification. It should be noted that unknown bodies may be recovered in fragments, it is therefore very important that antemortem data be as comprehensive as possible. Figures 3 and 4, show fragmentation in an aircraft accident.


5.1.4. Reports:

After completion of the comparison stages, the expert will be required to submit a report on his findings. He should report the outcome of every comparison made and all the information leading to the conclusion he has arrived at regarding the identity of a body. He should keep a copy of the report in case he may be called upon to give further information. (s. Keiser-Nielsen 1980. p.4-16).
5.2 ANTENORMETM DENTAL RECORDS

5.2.1 Antemortem Records:

The positive identification of unknown bodies by dental means requires that post-mortem and ante-mortem records be available for comparison. It is often found that ante-mortem records are not available at the time the dental expert is requested to begin his investigation. Since he does not know what records will be available, it is important that his post-mortem examination be as thorough as possible and complete with radiographs and models. Information of age, sex, new restorations, extractions and personal effects will help to narrow the field to probable victims and increases the chances of obtaining dental records early for comparison. Antemortem records and their sources vary as much as the dental records themselves. It is therefore essential to transfer information on antemortem records when found, to the same forms as used in the post-mortem examination. Comparison then will be made easier.

5.2.2. Types of Antemortem Charts:

Antemortem Charts in use today come in all sizes, shapes and colours. More than 150 different types are used around the world. The form of recording also varies as with the numbering system. Appendices A and B illustrate the different numbering systems. Appendix C also illustrates the different charts used. Investigating
dentist should always clarify information with his colleagues if he is not clear in his mind about any information that is found in an antemortem record.

6. THE METHOD OF RECORDING AND STORAGE OF DENTAL DATA IN THE PAPUA NEW GUINEA DEFENCE FORCE.

This chapter aims at the formulation of a dental form which can be used for servicemen, dependents and civilian workers in the (PNGDF) Papua New Guinea Defence Force. The form in use is too small and does not have room for recording detailed dental information which may be required for forensic identification. The designed form will have room for additional details and deciduous tooth notation. Figure 14 shows the present form HS14 introduced in 1973.

6.1 DENTAL RECORDS

Dental records are necessary for the purpose of recording dental information to:

1. Provide a treatment history to assist in the clinical management of individuals.

2. Provide records in case of claims or litigation.

3. Provide data for research and evaluation.

4. Provide for forensic investigations.

To achieve these, it is necessary to set an acceptable standard for recording dental data, storage and dispatching of these records. The Australian Arm Forces and the Papua New Guinea Defence Force work in close association.
Most methods of documentation are similar. It is therefore advisable to adopt as close as possible their forms and their system of recording, storage and dispatching of these dental documents, so that if required, there should not be any confusion or misunderstanding in interpreting information on these records by dentists from both Forces.

6.2 THE DENTAL FORM

This form will be in duplicate and will be known as HS-14A. It will be the main dental history and treatment form and will contain the following information: Figures 15 and 16.

1. Rank
2. Surname and Initials
3. Regimental Number
4. Unit or Ship
5. Treatment required, chart and teeth notation
7. Boxes for types of radiographs required
8. Boxes for Preventive Treatment required
9. Boxes for other treatment required which includes periodontal, prosthetic and other treatment required.

Note that detailed treatment required can be printed in section 12, The Examination, Diagnosis and Treatment column.

10. Column to indicate where treatment of examination was carried out.
Special Clinical Notes

<table>
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<tr>
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<th>Date</th>
<th>Treatment</th>
<th>Dental Offer</th>
<th>Dental Centre</th>
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Original Treatment Class

Current Treatment Class (In pencil)

Figure 14. Form HS14 Introduced Oct. 1073.
# DENTAL CLINIC RECORD

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<th>7. Radiographs</th>
<th>8. Preventive</th>
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<td>Plaque Index ☐</td>
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<td>Prev Periodontics ☐</td>
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<td>PD Counselling ☐</td>
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<td>Other</td>
<td>Prophylaxis ☐</td>
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<td>OHI</td>
<td>Tropical Fluoride ☐</td>
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<td>Scaling</td>
<td>Mouthguard ☐</td>
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<th>9. Other Treatment</th>
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<td>Dentures ☐</td>
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Figure 15. Designed Chart HS14A
# DENTAL CLINIC RECORD

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Figure 16. Designed Chart HS14B
11. Column for Date of Treatment or Examination
12. The Examination, Diagnosis and Treatment column.
13. Column to indicate class of filling being done or completed.
14. Column for the Name of the Operator
15. Column for the Signature of the Operator

The second form is HS14B. This is a continuation sheet of HS14A, and is to be used when HS14A is full. It has sections 1 to 6 and 10 to 15. It does not have sections 7 to 9. Initial examinations are numbered "1" in the folio section of the HS14A. If treatment is carried over onto HS14B before the next examination, which is an annual examination, it should be recorded as "1" in the folio section, since it's a continuation of HSB14A, folio 1. The first annual examination is to be recorded on a new HSB14A and is to be entered as folio 2. The third annual examination as folio 3 and so on. Continuation sheets HS14B are to be entered accordingly if required.

Both forms will come in duplicates. After an annual examination has been carried out, duplicates of the previous HS14A and HS14B are to be detached from the original and sent to the Central Records Office for safe keeping.

These forms are to be enclosed in a manila folder bearing the Rank, Regimental Number, the Name and initials of members concern and their units. A plastic envelope is to be enclosed to hold radiographs. Figure 16 shows HS14B.
It is not necessary to design other forms e.g. laboratory and referral forms as these are adequate and should be retained.

6.3 DENTAL EXAMINATION

There are four types of dental examinations:

6.3.1. Initial Examination:

This is conducted on enlistment or on a member who has not been issued with a dental record. Two copies of HSL4A are to be raised. One duplicate copy is to remain on members dental file and the other duplicate copy is to be sent to the Records Office. Both copies are to be entered as folio 1.

6.3.2. Annual Examination:

This is carried out annually and a new HSL4A is raised and is entered as folio 2 for any member who marches in after recruit training and attend a first annual dental examination. He is to attend this examination with the members of his unit. He is to disregard the time period between his initial and the first annual dental examination as his following annual examination will be on the same time as the rest of his Unit. Annual examination of each unit should be carried out the same month each year. If a member is not available at the time of his units examination, his unit is to arrange a suitable time for his examination as soon as he becomes available.
6.3.3. **Priority Examination:**

This examination is carried out as soon as it is known that a member is to be posted overseas or to a remote area. This examination and treatment should be completed before the member departs.

6.3.4 **Final Examination:**

This is conducted three months before a member is discharged. It should be treated as an annual examination and priority is given to make the member dentally fit before he is discharged, all his dental documents are to be forwarded to the Records Office. (DDS-A Instruction No.22 p.3-4. Australia Defence Force).

6.4 **RECORDING OF DENTAL EXAMINATION AND TREATMENT**

All post restorative treatment, missing teeth and prosthetic appliances found during initial examination are to be recorded. Any treatment required is also entered into the HSL4A. The following symbols should be used to designate the following:

1. **Restorations which are visible**
   - Amalgam - Block solidly all areas filled.
   - Gold - Score with horizontal lines
   - Synthetic and silicate cements and composites - score with diagonal lines.
2. Endodontic Treatment: Discovered during initial examination or completed after treatment should be shown by the letters RT (Root treatment completed) on the buccal area of the tooth concern.

3. Defective Existing Filling: The letters DEF is to be printed in pencil on the buccal aspect of the tooth concern. After treatment it can be erased.

4. Tooth Required Treatment: Any tooth requiring treatment should be shown by outlining the appropriate box(es) on the chart in pencil. This is to be filled in, or scored correctly after treatment.

5. Sound Tooth: A tick on the buccal aspects of a sound tooth will indicate it does not need treatment.

6. Exodontia: A tooth requiring extraction or oral surgery is to be shown by a single line drawn diagonally across the appropriate box. Details of the type of operation should be shown in section 12 of HS14A. After removal of the tooth, a second diagonal line is to be drawn across the first line to produce the letter "X".

7. Missing Teeth: This is to be shown by a horizontal line drawn across the appropriate tooth box. Where possible, a history is to be taken and recorded down in section 12 of HS14A.
8. Retained Roots: This is to be shown by the letters RR in the appropriate tooth box.

9. Unerupted Tooth: The letters UE (unerupted) is recorded on the buccal of the tooth concern.

10. Periodontal and Other Conditions: If treatment is required, these should be shown by a line drawn across diagonally in the appropriate box in section 9 in the dental form and details recorded in the diagnosis and treatment column.

11. Existing Crown and Bridge and Dentures: The words Crown and Bridge should be printed clearly on the buccal of the tooth boxes of the appropriate tooth concern. Where a partial denture exist, the letters PU should be printed on the buccal of the appropriate tooth box. In cases of full upper (FU) or full lower (FL) a horizontal line is drawn right across all the teeth concerned and the letters FU or FL printed on the buccal aspects of the jaw concerned in forms HS14A and HS14B.
6.5 COMPLETION OF EXAMINATION OF TREATMENT

Dental Officers and Dental Therapists should check all entries made by dental assistants before signing. Dental operators should print their names in column 14 and sign in column 15. Note that all entries are to be in blue or black biro and the words printed and not written. (DDS-A Instruction No.22, p.6-7).

6.6 TOOTH NUMBERING SYSTEM

The FDI numbering system as shown on the dental forms HS14A and HS14B is to be used.

6.7 MAINTENANCE, CUSTODY AND TRANSMISSION OF DENTAL DOCUMENT

1. Dental documents are Defence Force Property. Dental Centres are responsible to commanding officers for security and safety of these documents. All dental documents are to be kept at the area dental centres.

2. On march out to a new unit, the member concerned is to report to the dental centre and collect his document. He is to be present when it is sealed and the words "Dental in Confidence" stamped on the front and the back of the envelope used. This envelope is to be sealed in a second envelope
which is not to be marked Dental in Confidence
It is to bear the address of the next unit. The
receiving Unit should acknowledge with a signal
or a receipt. It should be noted that despatching
of the document can be by safe hand or by the
Defence Force mailing system.

3. Custody of the dental document is important.
These documents should not leave the unit
unless adequate receipts are issued or the
member leaving has signed for it.

4. In the event of a disaster, a list of victims
is to be sent to the (DHS) Director of Health
Services, who on receipt of this information,
signals dental officers of all Units. Names of
all involved is to be enclosed. The units are to
search for dental documents of those concerned
and seal them as described. These may be forwarded
to necessary authorities for the purpose of
forensic identification if required, or forwarded
to the DHS Office.
7. SUMMARY

The use of teeth as a means of establishing an identity has become as important and useful as fingerprints. In mass disasters where other recognisable features have been destroyed, dentition has proved useful in establishing identities. This has been shown in such incidents as the Mt. Erabus air disaster in which 257 people were killed when an Air New Zealand DC10 crashed. Out of these, 142 people were mainly identified by dental means.

Papua New Guinea relies a lot on air transportation as roads are fewer and difficult to build. The Papua New Guinea Defence Force uses this mode of transportation to transport goods as well as Servicemen and their dependants. It is therefore important that proper and thorough antemortem dental records are kept on servicemen as well as on dependants and other employees of the Defence Force. If required these records can give a lot of information towards establishing identities.

The FDI system of numbering is used widely now and therefore is being adopted into the HS14A and HS14B. When a notation becomes available, this will also be adopted. Many people from around the world travel through Papua New Guinea and if required the use of an FDI system of notation and numbering will be useful.
Forensic dentistry is a new subject to Papua New Guinea. It is hoped that dentists, pathologists, investigators and authorities may be made aware of this subject through reading and lectures from experts in this field so that a forensic team can be set up and trained to help bring about justice and help identify unknown individuals.
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APPENDIX A

DENTAL NUMBERING SYSTEMS

Some examples are given of the various methods used to designate teeth on charts.
Universal Numbering System which is used by the U.S. Arm Forces, the Public Health and the Veterans Administration Of the United States of America are illustrated below.

Universal Numbering System

Permanent Teeth

Upper Right 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Upper Left
Lower Right 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 Lower Left

Deciduous (Primary) Teeth

Upper Right A B C D E F G H I J Upper Left
Lower Right T S R Q P O N M L K Lower Left

or
Palmer Notation System

Upper Right  4D 5D 6D 7D 8D 9D 10D 11D 12D Upper Left
Lower Right  29D 28D 27D 26D 25D 23D 22D 21D 20D Lower Left

This system was used prior to World War II in the U.S.A. and is still used in some parts of Central America. It is also widely used in Papua New Guinea.

Deciduous Teeth

Upper Right  E D C B A A B C D E Upper Left
Lower Right  E D C B A A B C D E Lower Left
APPENDIX B

FDI DENTAL NUMBERING SYSTEM

This system has been adopted by the W.H.O. and is now being widely used.

Permanent Teeth

Upper Right
18 17 16 15 14 13 12 11
Upper Left
21 22 23 24 25 26 27 28

Lower Right
48 47 46 45 44 43 42 41
Lower Left
31 32 33 34 35 36 37 38

The designate teeth are pronounced one-one, one-two, etc. according to the quadrants. Each quadrant is designated the following:

Upper Right 1
Upper Left 2
Lower Left 3
Lower Right 4

Deciduous segments are designated the numbers 5, 6, 7, and 8.
### Deciduous Teeth

<table>
<thead>
<tr>
<th>Upper Right</th>
<th>Upper Left</th>
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<tbody>
<tr>
<td>55 54 53 52 51</td>
<td>61 62 63 64 65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lower Right</th>
<th>Lower Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 84 83 82 81</td>
<td>71 72 73 74 75</td>
</tr>
</tbody>
</table>

As with charts and the numbering systems, dentists use different abbreviations and symbols to designate tooth surfaces, treatment carried out and types of materials used. Some of the most common abbreviations are listed below: (S. Keiser - Nielsen 1980. p.9-16).

#### Tooth Surfaces

- Occlusal Surfaces or Occlusally = Occ
- Mesial Surface or Mesially = Mis
- Distal Surface or Distally = Dist
- Buccal Surface = Bucc
- Lingual Surface or Lingually = Ling
- Centrally = Cent
- Gingivally = Gin
- Labially = Lab
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>GCR</td>
<td>Gold Crowns</td>
</tr>
<tr>
<td>GIN</td>
<td>Gold Inlays</td>
</tr>
<tr>
<td>JCR</td>
<td>Jacket Crown</td>
</tr>
<tr>
<td>MIN</td>
<td>Metal Inlays</td>
</tr>
<tr>
<td>PCR</td>
<td>Post Crown</td>
</tr>
<tr>
<td>VMC</td>
<td>Veneer Metal Crown</td>
</tr>
<tr>
<td>Ag Am</td>
<td>Silver Amalgam</td>
</tr>
<tr>
<td>PU</td>
<td>Partial Upper Denture</td>
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<tr>
<td>PL</td>
<td>Partial Lower Denture</td>
</tr>
<tr>
<td>FU</td>
<td>Full Upper Denture</td>
</tr>
<tr>
<td>FL</td>
<td>Full Lower Denture</td>
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When in doubt about symbols or abbreviations used on Antemortem records, it will be of help if the dentist involved in the investigation contacts his colleagues to verify the information.
## Appendix C

**Examples of Common Dental Charts**

1.

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<th>DEBIT</th>
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### DENTAL CLINICAL RECORD

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#### Treatment required

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#### Radiographs

- Bitewings [ ]
- Periapical [ ]

#### Preventive

- Plaque Index [ ]
- Prev Periodontics [ ]
- PD Counselling [ ]
- Prophylaxis [ ]
- OHI [ ]
- Topical Fluoride [ ]
- Scaling [ ]
- Mouthguard [ ]

#### Other Treatment

- Periodontal [ ]
- Dentures [ ]

#### Dental Centre

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2. Chart used by Australia Defence Forces
PAPUA NEW GUINEA
DEPARTMENT OF PUBLIC HEALTH—DENTAL SERVICE
EXAMINATION AND HISTORY CHART

Name: ............................................................................. M/F

Home Address: ............................................................

School: ...........................................................................

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<th>CLASS</th>
<th>PRE-SCHOOL</th>
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<th>S. I</th>
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<th>S. III</th>
<th>S. IV</th>
<th>S. V</th>
<th>S. VI</th>
<th>F. I</th>
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<th>F. III</th>
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BUCCAL

RIGHT

BUCCAL

LEFT

LINGUAL

LINGUAL

BUCCAL

BUCCAL

History

DATE of BIRTH
/
/

OCCLUSION—
Normal
Angle's Class

Examined by

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<th>Date</th>
<th>Tooth</th>
<th>DETAILS OF TREATMENT</th>
<th>Operator</th>
<th>Inspected by</th>
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Govt. Print.—14482/20 000.—7.79

3. Chart used by the Public Health Department in Papua New Guinea
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3. Continued