Estonia Disaster

- M/S Estonia went down on September 28, 1994 between 00.30 and 01.00 at N 59° 23’, E 21° 42’ south of Finska Utö on her way from Tallinn in Estonia to Stockholm in Sweden
M/S Estonia
Estonia Disaster

- Between 1.005 – 1.022 passengers were on board; 110 in the crew
- Passengers were from 20+ nations
- The exact number of passengers will never be known
Estonia Disaster

- 136 persons, among them 53 Swedish citizens, were rescued

- 94 persons, among them 40 Swedish citizens, have been found dead

- 775-792 persons, among them 482 Swedish citizens, are still missing
Estonia Disaster

- Rescued Swedish citizens:
  - 41 men, mean age 43 years
  - 12 women, mean age 35 years
Estonia Disaster

Identification of the victims:

In Finland – post mortem examinations

In Sweden – collection of ante mortem material

In Finland - identification
Estonia Disaster

Collection of the ante mortem material in Sweden

- The National DVI Team responsible
- The local police visited relatives and filled in the Interpol’s Antemortem DVI Set
- Dental records were collected by the police
- Medical records by the Forensic Pathologist
The contents of the records were systematized and transferred to a data base.

The files with the updated date base and digitized x-rays were sent daily as encloses in e-mail to Helsinki via Interpol´s ISDN-net.

Two forensic odontologists worked full time during one month and four dentists part time at Forensic Medicine in Stockholm.
Estonia Disaster

- AM descriptions from 524 persons with relation to Sweden were collected
- 495 dental records have been found
- 29 records are missing
  - 14 reported to have full dentures
  - 5 foreign citizens
  - 10 records expected to be found
Estonia Disaster

The Swedish Dental Records

- 57% had entries from 1994
- 22% had entries from 1993
- i.e. 79% of the records were less than 21 months old
Estonia Disaster

The Swedish Dental Records

- 55% full description of the dental status
- 25% notes and x-rays that made a reconstruction possible
- 20% incomplete
Estonia Disaster
The Swedish Dental Records

91 % contained dental x-rays
75 % bite-wings
36 % full status
8 % panorama x-rays
8 % single x-rays
Estonia Disaster

The Swedish Dental Records

- 86 % amalgam fillings
- 55 % crowns and bridges
- 5 % full dentures
- 6 % full upper denture
- 6 % partial dentures
- 6 individuals had implants
Estonia Disaster

- A decision of lifting the ship
  - the sole purpose to recover and identify the bodies
  - divers recover as many as possible bodies in a suitable pace
  - lifting and tugging the ship to Muskö
  - building a temporary mortuary
  - extreme logistics
Estonia Disaster

- Decision not to lift the ship
  - practical difficulties
  - financial burden
  - moral implications
  - political considerations
  - the site was declared a graveyard
Estonia Disaster

...but the demands to rise the ship will never end...
Estonia Disaster

- Is it possible?
  - material
  - time
  - personnel
  - preparations
Estonia Disaster
Fire Disaster in Gothenburg

350-400 young people gathered for a private disco party in the hall of Macedonian Club in October 29, 1998

Mostly immigrants
Fire Disaster in Gothenburg

- The hall on the second floor, approved for maximum 150 people
- The only entrance 82 cm wide
- Windows 2 m above the floor
- Emergency exit blocked by furniture and fire
Fire Disaster in Gothenburg

- The fire was detected about 23.40 am
- Someone opened the emergency exit
- The alarm went 23.42
- Fire brigade came 23.49
- Chaos – the firefighters had difficulties to reach the building and get into it
Fire Disaster in Gothenburg

- After two hours
  - 63 dead
  - 213 injured
    - 150 in hospital
    - 74 in intensive care
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg

- Identification
  - 51 by association, confirmed by recognition
  - 12 by dental means
Fire Disaster in Gothenburg

- 12 dental identifications
  - 15 - 19 years old, mean age 17 y
  - 9 had characteristic therapy seen on x-rays
  - 2 had notations in records that explained differences between AM and PM status
  - 1 had no therapy
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Fire Disaster in Gothenburg
Thank you
Odontological Identification of the Victims of the Linate Aircraft Mass Disaster
118 VICTIMS

110 victims on the SAS MD87, flight SK 686 Milano-Copenhagen (104 passengers and 6 members of crew)

- 58 Italy
- 18 Denmark
- 20 Sweden
- 7 Finland
- 3 Norway
- 1 Rumania
- 2 UK
- 1 South Africa

4 SEA employees working in the hangar (Italians)

4 victims on the Cessna Citation II jet (2 German pilots and 2 Italian passengers)
severe body trauma

severe body and facial trauma

severely burnt

trauma+burnt

body parts

Condition of bodies
Severely burnt

Severe blunt trauma
ORGANIZATION OF IDENTIFICATION PROCEDURES I

ANTEMORTEM GROUP

✓ interview with family and ante-mortem ID forms filled out
✓ collection of ante-mortem data
  ✓ clinical data and x-rays
  ✓ dental data and x-rays
  ✓ photographs
  ✓ personal effects for DNA testing or swabs from relatives

✓ For Norwegian, Swedish and Danish victims, DVI teams
✓ For Finland, data exchange over the net
ORGANIZATION OF IDENTIFICATION PROCEDURES II

POST-MORTEM PHASE

(12 pathologists, 10 trainees, 2 dentists, 1 anthropologist, 2 geneticists, 1 lab technician, 2 morgue technicians)

✓ In situ screening and treatment of bodies at the hangar
Well preserved with suspicion of identity → Lambrate cemetery morgue

ORGANIZATION OF IDENTIFICATION PROCEDURES II

POST-MORTEM PHASE

(12 pathologists, 10 trainees, 2 dentists, 1 anthropologist, 2 geneticists, 1 lab technician, 2 morgue technicians)
Badly preserved or no suspicion of identity  ➔ University morgue

✓ External and internal examination, sampling for DNA, odontology and other identification procedures + toxicological sampling
✓ ID post-mortem form

☐ clothes, personal effects
☐ personal descriptors
☐ pathology
☐ odontological exam
☐ DNA sampling (muscle)
☐ sampling for aging (anthropology)
AM and PM information transferred onto a database

cross-matching by personal descriptors and anthropological data

DNA identification ODONTOLOGY

visual and/or unique personal descriptors
Manner of identification

14 days
Odontological identification

Overall odontological ante-mortem data:

- Dentist’s records, DVI forms: 56
- Xrays (14 OPGs, 129 bitewings, 65 periapicals, 2 CTs, 2 cranial antero-posteriors, 2 cranial latero-laterals)
- 5 casts
- Photographs (clinical (1), non-clinical (2))
After straightforward visual identification of well preserved victims within the first 24 hrs., odontological antemortem data for the remaining victims, 29 italians and 60 non italians, was requested. Antemortem odontological data for 27 Italians and for 41 non Italians arrived within 14 days.

<table>
<thead>
<tr>
<th></th>
<th>it.</th>
<th>non it.</th>
</tr>
</thead>
<tbody>
<tr>
<td>written data</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>“visual” data</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>written + “visual” data</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>italians</th>
<th>non italians</th>
</tr>
</thead>
<tbody>
<tr>
<td>periapical/bitewings x-rays</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>OPGs</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>cranial X-rays</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>CTs</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>casts</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>pictures in a “smiling” attitude</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>clinical pictures</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>interpol forms</td>
<td>-</td>
<td>39</td>
</tr>
<tr>
<td>dentist’s record</td>
<td>15</td>
<td>1</td>
</tr>
</tbody>
</table>

“visual” information in 81% of italian antemortem data and in 36% of non italian antemortem data.
Examination peculiarities:
- working at an autopsy table
- cleaning the remains

Preferable to:
- disarticulate
- perform a resection

ODONTOLOGY POST MORTEM
(78 examinations)
Dental condition of the 78 examined victims

in 42 cases there was no loss of dental data in relation to the accident
(all belonging to the category of “blunt trauma”)

21 of them were identified only on an odontological basis
4 identified with odonto+DNA (insufficient AM odontological data)
8 identified with DNA (no odontological AM data)
9 identified visually
Dental condition of the 78 examined victims

in 36 cases there was loss of dental data due to exposure to fire

3 of them were identified only on an odontological basis
14 identified with odonto+DNA (not enough odonto AM and/or PM data)
19 identified with DNA (no odonto AM and/or PM data)(12 had ¾ of dentition destroyed)
Post-mortem features examined and photographed

- external examination
- occlusion
- presence of teeth (am or pm loss, impacted, third molars, etc.)
- abnormal conditions
- pathologies
Post-mortem features examined and photographed

- conservative
- prosthetic
- orthodontic
- implants

No significant quality differences were found between Italian and Scandinavian dental work.

Slight differences were observed in the percent of composite and amalgam fillings: composite fillings were more frequent in Scandinavian victims than in Italians.

Implants were found only among Italians.
Post-mortem data were used to fill DVI forms and to build a post-mortem digital photographic archive (about 400 pictures)
**Odontological identification:**

**matching process**

**DVI form comparison**

**Radiographic comparison**

---

### Ante-mortem vs. Post-mortem

<table>
<thead>
<tr>
<th>Ante-mortem</th>
<th>Post-mortem</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 tooth present</td>
<td>no information</td>
</tr>
<tr>
<td>12 tooth present</td>
<td>no information</td>
</tr>
<tr>
<td>13 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>14 missing tooth &quot;diastema 2 mm&quot;</td>
<td>missing tooth &quot;dia 1.8 mm&quot;</td>
</tr>
<tr>
<td>15 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>16 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>17 amalgam filling Old</td>
<td>amalgam filling O</td>
</tr>
<tr>
<td>18 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>19 tooth present</td>
<td>tooth present</td>
</tr>
<tr>
<td>20 tooth present</td>
<td>tooth present</td>
</tr>
<tr>
<td>21 tooth present</td>
<td>tooth present</td>
</tr>
<tr>
<td>22 tooth present</td>
<td>tooth present</td>
</tr>
<tr>
<td>23 tooth present</td>
<td>tooth present</td>
</tr>
<tr>
<td>24 missing tooth &quot;diastema 2 mm&quot;</td>
<td>missing tooth &quot;dia 1.8 mm&quot;</td>
</tr>
<tr>
<td>25 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>26 intact tooth</td>
<td>intact tooth</td>
</tr>
<tr>
<td>27 amalgam filling O</td>
<td>amalgam filling O</td>
</tr>
<tr>
<td>28 tooth present</td>
<td>tooth present</td>
</tr>
</tbody>
</table>

**Compatibility:**

*Identificazione certa*
Conclusion

Odontological identification is a fast, cheap, powerful way of identification. Of the 78 victims examined 100% had been seen by a dentist.

Ante-mortem data are in most cases easy to find.

It is important to have well trained forensic odontologists in order to correctly fill out the DVI forms both for the ante-mortem and post-mortem phases, and for the consequent comparison of the AM-PM data.