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Identification Via Dental Remains: Pan American Flight 759

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ABSTRACT: Pan American Flight 759 crashed on takeoff from New Orleans International Airport on 9 July 1982. One-hundred-and-fifty-four persons lost their lives making this the second worst air crash in the United States. A dental identification team was assembled and began working the next morning. Ninety-three victims were positively identified by dental means and twenty-three other victims had strong supporting dental evidence as to their identities. The organization, method used, planning, and problem resolution concerning the dental team for this crash are presented.

KEYWORDS: odontology, human identification, aircraft, crashes

Conditions Leading to the Crash

Preparatory planning in anticipation of possible catastrophic eventualities is most essential in order to cope with the myriad concerns and details that surface when a mass disaster occurs. This fact was brought home vividly when Pan American Flight 759 crashed in Kenner, LA.

At 4:09 p.m. on Friday, 9 July 1982, Pan Am Flight 759, a 727-235 originating in Miami, took off from New Orleans International Airport bound for Las Vegas and San Diego. Less than 2 min later the plane crashed in a residential area of the Roosevelt Subdivision of the City of Kenner, killing all 146 passengers and crew on board and resulting in the death of 8 persons on the ground. Only the American Airlines DC-10 crash of 1979 in Chicago has had a higher death toll in the United States to date [1,2].

At the time of the crash the wind was from the east-northeast (070°) at 7 m/s (14 knots) with gusts to 10 m/s (20 knots) and more. The sky was overcast with a 1250-m (4100-ft) ceiling [3]. Investigations by the Federal Aviation Administration and other agencies refer to wind shear conditions present at the time. Wind shears are small-scale down drafts which cause an airplane to lose crucial lift on the wing and sometimes head into an irreversible

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dive. The crew's conversation with control tower personnel, as logged on the flight recorder, indicated some hesitancy on the part of the pilot to take off. The final decision was to proceed as scheduled and the aircraft began to roll eastward on Runway 10. The plane did become airborne; however, testimony obtained from observers in the control tower tends to establish the fact that the airplane never gained more than 46 m (150 ft) in altitude. Apparently, the left wing (or tail) struck a tree at a height of 15 m (50 ft) approximately 725 m (2376 ft) beyond the departure end of the runway. At that moment the jet was reported in level flight somewhat left of the runway center line. As a result of the impact with the tree, the craft attained a nose-high left wing down position. It made contact with a row of magnolia trees and utility wires about 90 m (300 ft) farther east, followed by the left wing striking the ground about 1160 m (3800 ft) beyond the runway [4]. The plane exploded into a huge fireball as it plowed a path of destruction 46 m (150 ft) wide and nearly four blocks long. The path, as filmed from the air, shows a distinct veer to the left. Six houses were completely destroyed and thirty more damaged. Several of the damaged homes were condemned and razed shortly thereafter as they were declared to be too hazardous for occupancy [1,3,5].

Victims and Survivors

The passenger manifest showed 136 persons, but there were 139 passenger deaths because 1 Pan Am employee was on board with no seat assigned, 1 infant was traveling in its mother's arms, and 1 female passenger was carrying a nearly full-term fetus. The unborn child was listed as a separate death by the Jefferson Parish Coroner. The entire crew of seven perished and eight persons on the ground were killed by the jet smashing through the homes.

There were only four survivors, all injured occupants of residences struck by the 727. Three badly burned casualties were rushed to a nearby hospital. One, a six-year-old girl, died the following morning. The fourth survivor, a 16-month-old infant, was discovered 4 h after the crash in the burned-out remains of a house in which her mother and 4-year old sister had died. She survived with only second-degree burns to her feet and ankles, apparently saved by a mattress which covered her.

The aircraft itself was nearly totally destroyed. Vivid descriptions given by rescue workers, verified by photographs taken by police and other authorities at the crash scene, indicated that only the jet engines, wheel assemblies, and part of the tail section were still recognizable aircraft structures. Metal and plastic parts of the jet, clothing and battered luggage, human remains and building rubble were strewn throughout the four-block area of the crash site. One cluster of victims was found in and near the tail section. Eyewitness accounts described terrible fires burning in the wreckage, an understandable aftermath to the crash because of the full load of jet fuel. It took firemen over 2 h to control the flames, finally permitting the rescue teams to enter the crash site and begin their search for victims and survivors [6].

The Temporary Morgue

The victim's remains, recovered at the crash site by the Jefferson Parish Sheriff's Office and the Kenner Police, were brought in vinyl bags to a Delta Airlines cargo hangar serving as a temporary morgue. The bags were transported in large refrigerated trucks. Recovery crews worked all night and by the morning of July 10th nearly half of the remains had been transported. Each black body bag was labeled with white spray paint, for example, A-1, B-13, at the crash site, the letter indicating the recovery team and the digit(s) the order in which the remains were found. A tag was attached to each body part bearing the same designation as the bag containing it and these same identification numbers were used by the police, the FBI, and the dental teams to avoid confusion.

The arrangements for body examinations were simple but efficient. Two examination tables were set up in the center front of the hangar, immediately behind the refrigerated

trucks. The medical examiners, pathologists from the Orleans Parish Coroner's Office and the Jefferson Parish Coroner's Office, opened body bags on these tables, meticulously examined the contents, and identified articles of clothing and personal possessions found with the remains. All this information was recorded by the Jefferson Parish Sheriff's Office and all items of value were tagged and bagged for safekeeping, eventually to be returned to the families of the victims. Since one destination of the flight was Las Vegas, many passengers were carrying large sums of money (some victims had several thousands of dollars), a possible (though somewhat remote) aid in establishing identity.

A thorough examination was made of each victim, detailing all distinctive anatomical features. When the medical examiners completed their exam, the body bags were moved to two adjacent tables for the FBI fingerprint team. Distal phalanges of all fingers were removed and fingerprints recorded at a side worktable. Fingertips that had become shriveled were injected with materials to restore tissue contour before imprinting. The FBI team also carefully dissected skin from badly charred fingers, placing it on their own gloved finger to register the print.

The forensic dentists in charge requested that two additional tables be placed behind those of the FBI group, thus permitting the body bags to be moved sequentially the shortest distance possible. They further asked for two tables to be set up off to the side with a mobile dental X-ray unit placed between them, and three tables, end-to-end, along the far side of the hangar for sorting and filing records, reading radiographs on viewboxes, and making antemortem and postmortem record comparisons (see Fig. 1).

The Dental Identifications

The reaction of the dental community to announcements of the disaster was predictably positive. Drs. Ronald Carr, Joseph Cuminale, and Robert Barsley, active in forensic odontology at the Louisiana State University School of Dentistry, immediately began receiving telephone calls from dentists offering assistance in identifying the victims. All volunteers were thanked and were assured that their help was vitally needed because of the enormity of

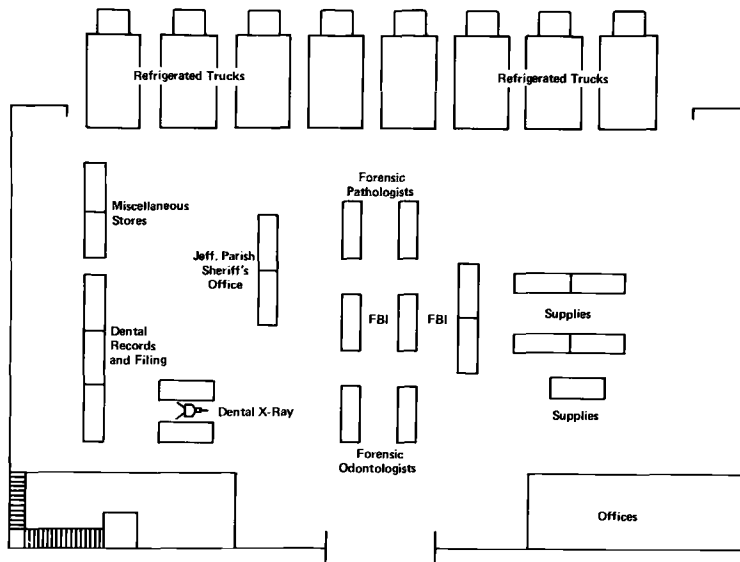


FIG. 1—Layout of the hangar used as a temporary morgue.

the task. It was clear by late Friday night that there would be no survivors from the aircraft. The number of ground victims had yet to be ascertained. The basic dental team met at 8:00 a.m. Saturday, July 10th at the Delta Airlines cargo hangar at Moisant Airport. Also present were representatives from Pan Am, the Jefferson Parish and Orleans Parish Coroners' Offices, the Jefferson Parish Sheriff's Office, the local Federal Bureau of Investigation office, and the National Transportation Safety Board.

Dental volunteers continued arriving and participated as much as time and circumstances permitted in the identification effort for the next six days. Organizing these volunteers into teams, explaining duties and assignments to them, acquainting them with forensic science methodology, coordinating efforts with the medical examiners and the FBI fingerprint team, sorting and classifying the charts and radiographs of the dental remains, sifting through the antemortem dental records of the victims, converting various tooth-numbering systems, and establishing positive, probable, and possible identifications began immediately.

The dental team was organized as follows:

Dr. Carr was the overall coordinator and the only member authorized to sign final identifications by virtue of his professional association with the Orleans Parish Coroner's Office. Dr. Cuminale was placed in charge of all postmortem examinations and charting. Drs. Barsley, Cottone, and Mann were designated to collect and compare all premortem and postmortem dental records. Whenever a consensus concerning an identification was apparent, the identification was presented to Dr. Carr for certification. Two of the volunteer dentists were assigned to operate the dental X-ray equipment.

One member of the dental team was stationed at each of the medical examiners' tables to initiate the dental charting, entering the date, body bag number, race, sex, and approximate age when possible, along with a notation indicating whether there were dental remains to be charted. Charts were immediately given to Dr. Carr and the other dentists at the records table when no dental remains were present in a body bag. Where dental remains were present, the chart was so notated and given to Dr. Cuminale who assigned it to one of the examining and recording teams. All charts were reviewed by him for accuracy and signed by both the examiner and the recorder. Next, the body bag was moved to one of the dental X-ray tables and radiographs were taken of all dental structures. A notation of the X-ray procedure was placed on the chart. The body bag was then returned to one of the refrigerated trucks reserved for those bodies whose examinations had been completed.

The dental examination teams charted the remains found within 156 body bags of the total of 235 such bags transported to the morgue. Rigidity of tissues prevented good visualization of the entire oral cavity with many of the badly charred bodies. On these bodies buccal and facial incisions were made and the tissues were reflected back to expose the dental structures. A reciprocating saw was used on the buccal aspect of the ascending ramus, cutting it bilaterally parallel to and at the level of, the occlusal plane. The mouth could then be easily opened, cleaned, and examined. Care was taken to examine all restorations and accurately record their location and type. Many teeth were fractured or traumatically avulsed which was also noted on the postmortem chart. A problem encountered by the examination teams was the postmortem chart used. Although this chart had large tooth representations upon which very accurate forms could be drawn, the data lines did not correspond very well to these representations. This created an additional difficulty, particularly in the molar area, which was resolved by careful cross-checking.

The record keeping system was simple and worked efficiently. Postmortem findings were filed under one of six categories by body bag number. These categories consisted of adult males, adult females, adults of undetermined sex, cockpit occupants, children, and remains without any dental components. Figure 2 is a representation of the record boxes at the temporary morgue. Postmortem findings were summarized in a notebook. A sequential listing of

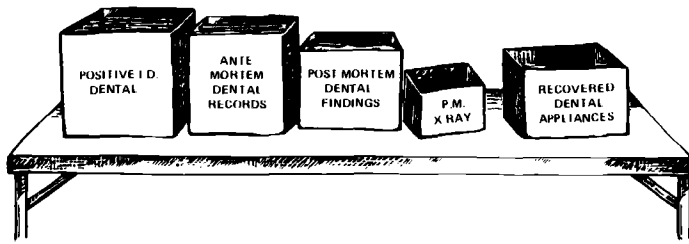


FIG. 2—Dental records table. Small box contains developed radiographs filed by body bag numbers.

body bags was begun noting each body's sex. A space was left to enter either the suspected identity or NDR (no dental remains). The final column contained an abstract of the most vivid postmortem dental finding as shown in Fig. 3. This notebook proved to be quite useful as it contained only seven pages yet could provide a great deal of information at a glance. Often, victims, members of a family, were found in close proximity to each other. This was reflected in sequential body bag numbers. Thus, a quick reference was available to permit a rapid search of recorded findings for comparison. As bodies were identified, appropriate notations were entered in this notebook. Figure 4 shows the distribution of the remains.

As bodies were positively identified, a summary was entered on the postmortem chart containing the name, date, and origin of the antemortem records relied upon. A master list of confirmed positive and supportive identities was kept. This information was continuously shared with the coroner's office and the FBI. Many very fruitful exchanges of information were made among the three groups.

The dental team dealt with the antemortem dental records in singular fashion. It was decided not to transcribe the antemortem information onto a new chart. Rather, each record was carefully read and any premortem radiographs viewed. The record was then placed in a manila folder with the outer edges stapled shut to avoid any loss of contents and the person's name written across the top. The face of each folder showed an abstract of the outstanding dental features. Since one of the authors (REB) prepared virtually all of the postmortem and

Bag #	Sex	Suspected ID	Remarks/Abstrance
A-36	M	MAUSE, Dr. John Doe	MAX. IDENTIFIED ^{SIGNED OUT} ONE FINGER
A-37	F	Mary Doe (suff.)	TILMAN REGION - NO CARIES
A-38	M		ANT. C.F.B.
A-39	M	John Q. Public	17. FGC 31 FGC 32 11mm FBI ✓
A-40	F	James Roe	21 PFM SIGNED OUT FBI ✓
A-41	M	Paul Roe	AMAL. 27R. 28. FACIES
A-42	F	Pedo	20 deciduous, AN. COMES. FRAG.
A-43		NDR	
A-44		NDR	
A-45	F	Jan Q. Public	AMAL. 12R. 13R. 14R. 15R. 16R. 17R. 18R. 19R. 20R. 21R. 22R. 23R. 24R. 25R. 26R. 27R. 28R. 29R. 30R. 31R. 32R. 33R. 34R. 35R. 36R. 37R. 38R. 39R. 40R. 41R. 42R. 43R. 44R. 45R. 46R. 47R. 48R. 49R. 50R. 51R. 52R. 53R. 54R. 55R. 56R. 57R. 58R. 59R. 60R. 61R. 62R. 63R. 64R. 65R. 66R. 67R. 68R. 69R. 70R. 71R. 72R. 73R. 74R. 75R. 76R. 77R. 78R. 79R. 80R. 81R. 82R. 83R. 84R. 85R. 86R. 87R. 88R. 89R. 90R. 91R. 92R. 93R. 94R. 95R. 96R. 97R. 98R. 99R. 100R. SIGNED OUT FBI ✓
A-46	F		EDDENTALOUS
A-47		NDR	
A-48	F	Alice Doe	21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. SIGNED OUT
A-49	F	Fanny Foo (suff.)	STEEL BAND TEETH, AMAL.
A-50	M	CHLO	20 deciduous, NO RESTORATION
A-51	F	Lori Lee	17 CARIES SIGNED OUT

FIG. 3—Facsimile of abstract notebook. Sex, race, and dental remains abstract can be seen. NDR stands for no dental remains. FBI designates those identities independently verified by fingerprints.

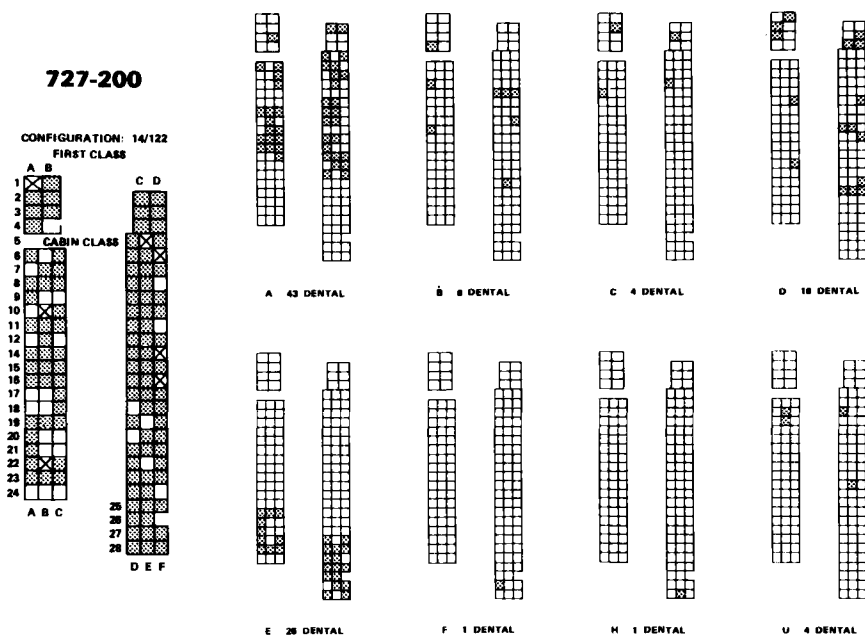


FIG. 4—(a) Seat location of the 103 passengers identified by dental means. X denotes victims for whom records were available but dental identification could not be made. (b) Distribution of dental IDs according to seating records and body recovery team (A, B, D, and so forth).

premortem abstracts, he was often alerted to similarities in the findings and was able to quickly seek out and compare findings as new records became available or were generated. Other members of the record team also searched for possible match ups. When a possible match was found, record team members viewed the comparison in order to affirm or refute the identity. An affirmative consensus of the record team was necessary to establish a positive identification.

The dental team was acutely aware that the number of dental volunteers would understandably dwindle each day the task was extended. This system allowed the dental team to make all possible dental identifications within nine days. Accuracy of identifications was the primary goal. All victims were identified within two weeks except for one gentleman who was traveling under an alias. He was later identified by the FBI fingerprint team.

The final results obtained from the forensic dentistry effort were:

- 93 positive dental identifications and
- 23 more with very strong supporting dental evidence.

This is a total of 75% of all identifications (Table 1).

Discussion

Of the actual remains 117 were identified; however, the right and left halves of a single victim's maxilla were found in separate body bags. The total of 116 of 156 (75%) dental identifications must be considered in light of a major difficulty in forensic odontology, namely, the failure to obtain premortem dental records on every victim. Only 123 antemortem dental records were received for the 154 victims involved, and the quality of these records varied greatly. One record was a recollection by a family member of the victim's teeth

TABLE 1—Statistical treatment of forensic odontology and Flight 759 comparing continental United States with areas outside (including U.S. territories).

	Continental United States			Non-continental United States	Overall
	Louisiana	Other States	Total		
Positive Dental ID	80.5%	67.9%	73.4%	40.0%	60.4%
Supportive Dental ID	—	3.8%	2.1%	35.0%	14.9%
Total Dental ID	80.5%	71.7%	75.5%	75.0%	75.3%

since the victim had never visited a dentist and extracted her own teeth. However, most records were recent, well kept, and complete with radiographs. Some practitioners sent valuable summaries of the oral condition of their patients. Since 60 of the passengers lived in localities outside of the continental United States, a wide variety of charting systems and records in foreign languages was encountered. Some of these records were interpreted easily, others with varying degrees of difficulty. Sixteen geographic regions besides the continental United States were represented on the flight. Figure 5 summarizes the results by region of origin. The authors feel that had they received postmortem dental records on all of the victims, an overall percentage equal to the 94.3% success rate for those 123 victims with such premortem dental records could have been achieved.

Another problem concerned the postmortem radiographs. The lack of on-site film developing facilities was a major inconvenience. This made it necessary to transport large quanti-

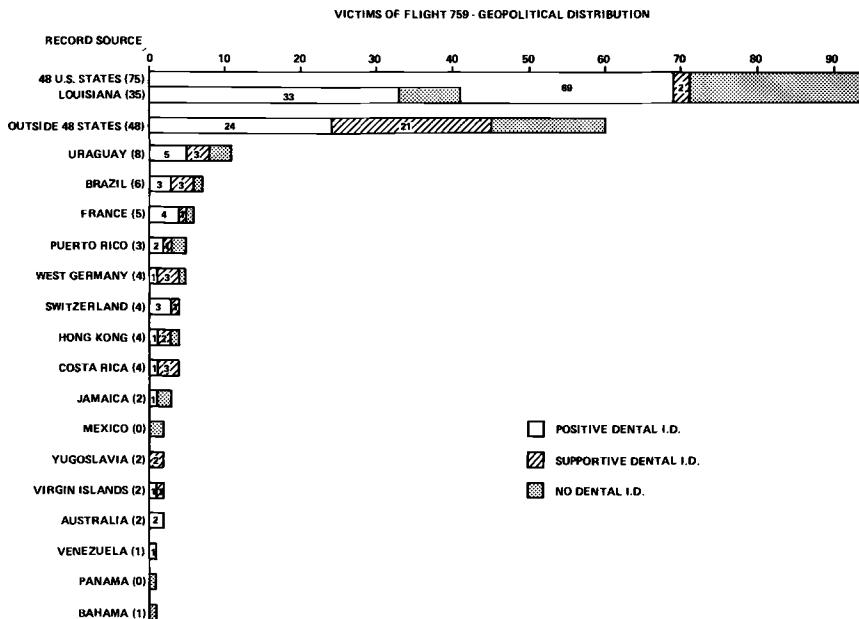


FIG. 5—Geopolitical distribution of passengers on Flight 759. Numbers in parentheses detail how many antemortem records were received from each locale. (Forty-eight states are those contiguous in North America, although not all forty-eight states had crash victims).

ties of numbered, exposed film to local dental offices for processing. Accomplishing this without creating confusion was a tedious and time-consuming task and delayed many identifications by a full day. An even longer delay resulted if retakes or additional films were deemed necessary for adequate comparisons.

Another radiographic problem concerned images on some postmortem film. Many bodies were severely traumatized because of the tremendous impact of the aircraft with the ground. Some radiographs were exposed with the film placed buccal to the jaw fragments rather than lingual. The resultant radiographs were somewhat confusing initially until the reviewers were apprised of this situation and were therefore able to interpret correctly these radiographs.

These difficulties notwithstanding, forensic dental evidence was one of the most reliable means available for establishing the identity of the victims primarily because of two essential factors, namely, the durability of dental structures and the careful records kept by most practitioners. All systems of identification have their limitations. Therefore, cooperative efforts on the part of numerous and diverse experts are needed, as exemplified by this disaster.

The FBI fingerprint experts were able to make 50 positive identifications. Again, one must bear in mind that fingerprints can be used for identification purposes only if:

- (1) sufficient fingerprinting material exists after impact, fire, and other destructive elements and
- (2) the individual's fingerprints are on record.

Despite the ruinous force of impact and the incinerating heat of fire, some victims were visually recognizable and some others could be tentatively identified by artifacts in their possession.

Acknowledgments

Although the dentists who volunteered their services came from various divisions of the dental profession and few had experienced forensic science tasks of this magnitude before (most had no prior experience) they acquitted themselves very well indeed. It is fitting to recognize all persons and organizations who participated so willingly in this unpleasant but necessary task.

The LSU School of Dentistry strongly supported the effort, permitting volunteer faculty members, graduate, and undergraduate students to participate, thanks to its Dean, Dr. Jack H. Rayson. The dental school also provided dental X-ray films, mobile lights, and other equipment.

Several practitioners also gave of their time. Dr. Willard K. Mann, in particular, was able to obtain the use of a mobile dental X-ray unit which was loaned to the forensic dental team by the dental department of Hotel Dieu Hospital. Dr. Mann processed many of the films in his office at night. Others were developed in dental offices near the airport.

Other governmental agencies, police and civil, too numerous to mention were also involved. It would be unfair to list any agencies at the risk of overlooking others that also provided needed support.

Tragedy and devastation engender problems and difficulties and these, in turn, bring awareness to those who must cope with them. There is a very important lesson to be learned from this calamity: preparedness.

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