

ORIGINAL ARTICLE

H. Borrman · U. Dahlbom · E. Loyola · N. René

Quality evaluation of 10 years patient records in forensic odontology

Received: 20 June 1994 / Received in revised form: 26 April 1995

Abstract In forensic odontology, accurate detailed and complete recording of ante-mortem information is essential as the basis for odontological identification. Earlier studies on malpractice cases in Sweden indicated that the quality of the recording procedure was not always acceptable. Therefore, the aim of this retrospective study was to investigate the quality of ante-mortem records and its possible implications for identification work. All forensic odontology cases referred to the Department of Forensic Medicine in Göteborg between 1983 and 1992 were studied with regard to the instructions for dental records from the National Board of Health and Welfare. Information on dental characteristics, normal anatomical findings and restorative treatment was complete in 43 (68%) of the cases, incomplete in 17 (27%) and missing in 3 (5%). Registration of previous therapy was missing in about 75 (94%) of the records. It was possible to identify patient radiographs in only 16 of the 40 records where radiographs were available. In spite of this, the inaccuracies in the records did not seem to hamper the identification procedures in this study which could be explained by the character of the cases and the availability of medical and circumstantial information.

Key words Forensic odontology · Quality of dental records

Introduction

In forensic odontology, accurate, detailed and complete recording of ante-mortem dental information is essential

[5] for comparison with the post-mortem information about the deceased person during the identification procedure. As pointed out by several authors [4, 7, 10], dentists have a medico-legal obligation and a social responsibility to exercise great care in the documentation of the treatment procedures. The quality of the ante-mortem dental records, which serve as evidence, is very important in forensic work [2] and deficient ante-mortem charting could hamper forensic odontology casework. Furthermore, the remains of the deceased may be fragmented and/or limited creating problems especially if the dental records are insufficient. Thus, as discussed by Keiser-Nielsen [9] a post-mortem jaw sector might not correspond to any chart registration at all. In such cases a positive identification is not possible since identification stands or falls by the existence of comparable ante- and post-mortem data. Furthermore, it was demonstrated in a survey of 27 years experience in forensic odontology in Göteborg, Sweden [3] that about 50% of the cases concerned burned or mutilated victims with fragmented jaws and/or teeth. These results emphasize the importance of good quality ante-mortem data for comparison with the post-mortem information.

Hill et al. [8] analysing the identification of victims of the Manchester air disaster encountered significant problems of the ante-mortem recording and stated that there is no formal requirement to update treatment records in Great Britain. Solheim et al. [14] also found deficiencies in recording when analysing the patient records from an air disaster. Their results showed that none of those records included any information about previous dental treatment which can be of utmost importance in forensic work. Earlier studies of dental malpractice cases in Sweden have indicated that the quality of the recording procedure was not always acceptable [12, 13]. Furthermore, a recent study of the quality of dental records in both general and specialist dental care [11] indicated deficiencies especially of the general dental care records. Since Sweden, in addition to legislation, has instructions for dental records issued by the Swedish National Board of Health and Welfare (SOSFS), it should be of interest to study the

H. Borrman (✉) · E. Loyola
Faculty of Odontology, Göteborg University,
Medicinaregatan 12, S-41390 Göteborg, Sweden

U. Dahlbom
Department of Statistics, Göteborg University, Sweden

N. René
National Board of Health and Welfare, Malmö, Sweden

quality of dental records used for identification purposes. With this in mind the quality of the dental records were examined from a 10-year period in Göteborg. We also evaluated if the quality of the records could have had an influence on the identification procedure.

Materials and methods

All forensic odontology cases from the police department in Göteborg and surrounding areas, referred to the Department of Forensic Medicine in Göteborg during the period 1983–1992, were studied. From a total of 163 dental records 80 were evaluated. Dental records from 83 identification cases could not be analysed or were not included in the study because they were returned to the dentists after the identification procedure was completed. Moreover, 10 of the deceased persons were not Swedish citizens (Denmark 4, Norway 2, Germany 1, USA 3).

Of a total of 80 evaluated records, 51 came from public dentistry and 24 from private clinics: 2 dental records came from specialists and 3 could not be identified with regard to the treating dentist. From some dentists more than one record was available. Different parameters in the dental records were evaluated according to a standardized form which has been described previously [11]. The parameter "permanent writing" was not evaluated since several of the records were photocopied and the original documents were sent back to the dentists.

Results

Frequencies of correct documentation of parameters in accordance with SOSFS 1989:50 in 10 years patient records in forensic odontology are shown in Table 1.

Patient identity:
name and birthdate completely documented or not

Information about the patient's identity was complete in 71 cases and incomplete in 8 cases. The identification number (for example 510424-5146, i.e. birthdate as year, month and day, plus a four-digit control number) was incomplete. In one case no information about this parameter was available. In 52% of the 71 correct cases the address was missing.

**Documentation of dentist responsible
and notes about patient visits**

In 47 cases, a single dentist made all notes in the records whereas several dentists (2–9) were involved in the treatment of 32 cases.

Data about who delivered the treatment was acceptable in 28 (60%) of the cases and unsatisfactory in 19 (40%). This parameter was assessed only where one dentist alone treated the patient ($n = 47$).

Notes for separate patient visits ($n = 79$) were extensive in 1 (1%), satisfactory in 64 (81%) and minimal in 14 (18%). In one case no information was available.

Signature

Among 78 cases which could be evaluated with regards to signature, only 5% were correctly made.

Table 1 Frequencies of correct documentation of parameters in accordance with SOSFS 1989:50 in ten years patient records in forensic odontology

Parameter	Correct	<i>n</i>
1. Patient identity	90%	79
2. Name of dentist	60%	47
3. Detailed record notes	82%	79
4. Signature	5%	78
5. Proper corrections	79%	57
6. Documentation of anamnestic findings	29%	79
7. Documentation of status	68%	63
8. Documentation of diagnoses	86%	64
9. Patient identity on radiographs	40%	40
10. Date on radiographs	58%	40
11. Radiographs in systemic order	60%	40
12. Documentation of therapy plan	8%	63
13. Documentation of prognosis	2%	63
14. Documentation of drugs-type/name	88%	65
15. Documentation of drugs-concentration	11%	65
16. Documentation of drugs-volume	39%	65
17. Documentation of drugs-dosage	29%	14
18. Dental materials-type	92%	74
19. Dental materials-company name	1%	74
20. Referral forms countersigned	72%	7

Explanation of the different numbers.

- 1: In one case name and birthdate were missing.
- 2: The values represents the cases in which only one dentist treated the patient.
- 3: In one case there was no note.
- 4: In 2 cases this parameter could not be estimated.
- 5: It was only in 57 cases that corrections had been made.
- 6: In one case there was no need for anamnestic findings.
- 7: In 17 cases there was no need for status, because of the acute nature of the treatment.
- 8: In 16 cases there were no diagnoses to note.
- 9–11: In 40 cases no X-rays were taken.
- 12–13: In 17 cases there was no need for therapy plan and prognosis, because of the acute nature of the treatment.
- 14–16: It was only in 65 cases that local anaesthesia was given.
- 17: It was only in 14 cases that prescriptions had been administered.
- 18, 19: Dental materials were only used in 74 cases.
- 20: It was only in 7 cases that referral forms were found.

Corrections; properly made or not

Corrections of the notes were not properly (crossing out or "painting over words") made in 12 cases ($n = 57$). Since several dentists were involved in the treatment, both correct and incorrect corrections were found in 12 of the records. Thus, the remaining 33 (58%) had no corrections at all, or were photocopied records.

Documentation of anamnestic findings

Anamnestic information was available in 23 (29%, $n = 79$) of the records. Diagnostic information was available in 55 (86%, $n = 64$) of the records.

Documentation of status

Information about dental condition at examination, normal findings and restorative treatment was complete in 43 (68%), incomplete in 17 (27%) and missing in 3 (5%) of the 63 records.

Documentation of diagnoses

Documentation of diagnoses was complete in 86% of the records ($n = 64$).

Radiographs, documentation of patient identity, date of treatment, consequently stored or not

Radiographs were not available in 40 cases. For the other 40 cases the radiographs were identifiable to the patient in 16 cases. In the remaining 24 cases, information about patient identity was missing. The information regarding therapy etc. as seen on the radiographs was similar to the notes describing status in the records. Thus, the radiographs belonged to the records that they were placed in. Information about when the radiographs were taken was available in 23 cases (58%) and 60% of the radiographs were placed in their records in systematic order.

Documentation of therapy plan and prognosis

Registration of therapy plan was available in only 5 (8%) of the records and information about prognosis was mentioned in only 1 (2%) of the records.

Documentation of pharmaceuticals administered

Where drugs were used, information about the type was adequately mentioned in 57 (88%) of the 65 cases. However, there was information about the concentration or the amount/volume of the drug in only 7 (11%) and 25 (39%), respectively. The dose was mentioned in 4 (29%) of the cases.

Documentation of dental materials; type, company name

The types of materials used were stated in 68 (92%) of the 74 cases, but the commercial name of the product was stated in only one case.

Referral forms

Referral forms were made in 7 cases and of these 72% were complete.

Discussion

Quality assurance programmes can lead to improvement in the quality of dental records. The study is a part of a systematic evaluation of dental records by the Swedish National Board of Health and Welfare.

The number of records analysed represents about half of the solved forensic odontology cases, because some the records were returned to the dentists after the identification. However, a copy of the dental records is now always filed together with the identification report. Since the aim was to study how Board regulations are being followed, we believe that this selected material contributes to our knowledge of "field work". The records represent only forensic cases i.e. not always representing average citizens. This might be an explanation why the quality of the records was very variable (Fig. 1 and Fig. 2a, b). Records from private and community dental care were not separated since the aim was not to compare these 2 categories. This has been done previously [11] in a study which indicated that the records from private dental care did not follow the recommendations as closely as those from public dental care. At present, a continuous quality evaluation programme in which all dental personnel should take an active part is being strongly encouraged [16]. This will perhaps result in a higher awareness among dentists responsible of how records should be kept.

Information about the patient's identity was missing in one record. But since the identity was based on both medical and dental characteristics in this case, the error did not hamper the outcome of the identification procedure. However, from a legal point of view, one record without the patient's name and pin number is one too many. In a recent study [11] of the quality of patient records in Swedish dental care, correct documentation of patient identity was found in 99.6%. Where the information about identity was incomplete, the birthdate was most often missing. This is important in Sweden because the birth-

-4 NERK. Pulp.
RENSIVING
DUS PROBLE
LAMINAR OPPEN
REC. CALCIOREN 16
N: 0 KX
HALLERMAN

Fig. 1 Dental record from emergency treatment. No radiographs were available

Titel						Nr	
Ar. mån. dag. nummer							
Tand	Status	Terapi				Nr	Arv. totalt
1.2	11	m.c.	u.s.			11	60
1.7	11	m	5-mo	4 c.		57	95
3.2	11	m	+6 mo	12 c.		54	63
2.1	11	m	1 + 1 m	12 c.		58	142
Obs	11	m	3 m	12 c.		57	92
Slut	11	m	12 c.	12 c.		28	190
forak 22.10.81							
1.2	11	m	u.s.			11	60
1.7	11	m	5-mo	4 c.		57	95
3.2	11	m	+6 mo	12 c.		54	63
2.1	11	m	1 + 1 m	12 c.		58	142
Obs	11	m	3 m	12 c.		57	92
Slut	11	m	12 c.	12 c.		28	190
forak 22.10.81							

a

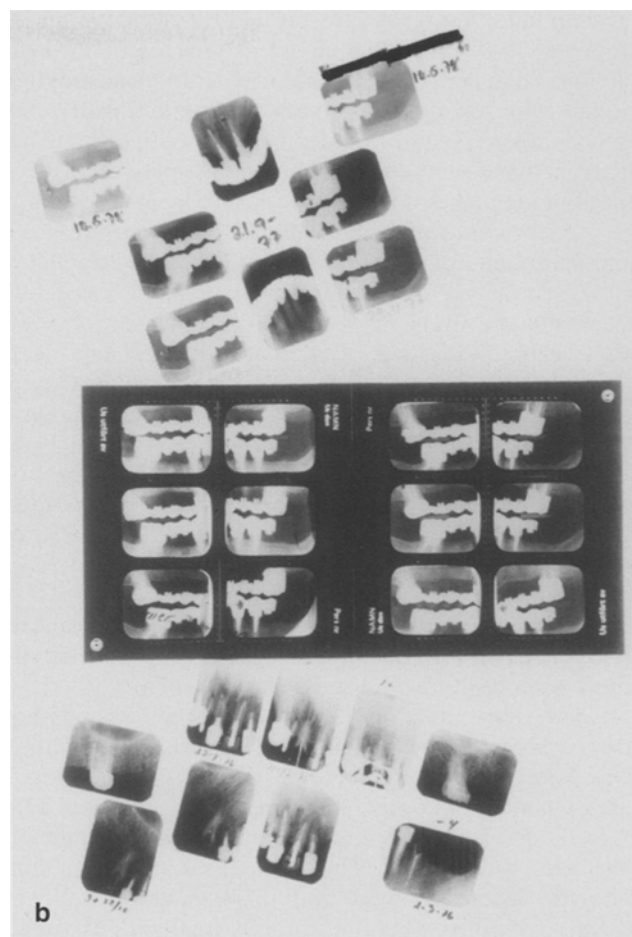


Fig. 2 Dental record (1 page, as example) with extensive treatment (a) including several radiographs (b)

date including the identification number, is personal and unique, and thus a definitive proof of a person's identity is possible in contrast to first name and family name alone where several persons can have the same name. The importance of the general information about the patient (birth date, identification number etc.) was illustrated in the description of the 1988 airplane accident in Torghatten, Norway [14]. For the 36 deceased persons in that accident, only 9 records (25%) met the requirements for general information laid down by the Ministry of Social Affairs in 1983. The quality of records in forensic odontology especially in Norway seems to vary. In an analysis of the identification of fire victims in the Nordic countries during the period 1983–1992 [1] it was noted that the quality of the antemortem information was good to excellent in two-thirds of the cases ($n = 292$). This agrees with the results following the Scandinavian Star disaster [15] in which mostly Norwegian victims were identified. The ante-mortem material in that accident was of good quality in 75 (94%) of the cases.

Regarding Torghatten victims ($n = 36$), documentation of dental condition at examination (status), normal findings and restorative treatment was incomplete in 17 (47%), and missing in 3 cases (8%). It is notable that previous dental treatment was not mentioned in any of these records. This can be very important since many forensic

odontology cases involve fire victims in which the tissue has been mutilated, destroyed or altered by the heat. As much information as possible about anamnestic findings, status and diagnoses must be included in records especially because post-mortem material can be very sparse. Despite the absence of status documentation in 3 cases (8%) in the Torghatten study, the notes in the records and the findings on the radiographs sufficed for the identification procedure in the present material. The documentation of status in the present study was better ($n = 63$, 68%) than the findings (53%) in a study of 465 records from 96 dentists in Sweden [11]. Documentation of therapy plan was only found in 148 (32%) of the records, but therapy plans might not be necessary for all patients.

The radiographs in the present study were identifiable to the patient in 16 cases (40%, $n = 40$). This is not satisfactory because even though the radiographs are supposed to be placed together with the dental record they could be lost. To prevent wrong filing or loss, radiographs should be labelled and mounted promptly [6]. Radiographs could have been included in more records than this retrospective study indicated, but the results suggest that the radiographs were not properly marked.

Radiographs are very important for legal reasons because they display details that can be compared ante- and postmortem, for examination by legal authorities if neces-

sary. In addition, they are an aid to determining the uniqueness of an individual when characteristic dental findings coincide. This is particularly true for young individuals with few or no restorations. Internationally, radiographs are very useful since they can be interpreted by different dentists without the inherent disadvantages of different languages and classification systems.

There was no information about the concentration or amount/volume of the drug in 58 (89%, $n = 65$) and 40 (61%, $n = 65$) of the cases, respectively, and dosage was not mentioned in 10 (71%, $n = 14$). However, type was described in 57 (88%, $n = 65$). Pharmaceutical data can be important in cases of sudden death during dental treatment, where information about type and concentration of the administered drug is important.

Documentation of dental materials giving type was well described in 68 cases (92%, $n = 74$), but the company name was only mentioned in one case (1%). Such information can have direct implications for identification work.

One possible explanation why the use of dental materials has been so well documented could be that dental materials have been much discussed in Sweden.

From a legal point of view, it is important to study how corrections in the records are made. In this study, corrections were not properly made in 12 cases (21%) of the 57 cases where corrections had been made. But since 23 of the records were photocopied, corrections could not be satisfactorily analysed. Thus, the results are not completely in accordance with those of Rasmusson et al. [11] where corrections were not properly made in 56% of the records with corrections. This might be explained by the fact that several records in the present study were not very extensive. It is important to analyse the different types of corrections made in the records and especially in what part of the records the corrections were made. The corrections were found in the identification part, in the part describing the daily notes, and/or in the status registration part i.e. charting errors. Common corrections were changes of patient's phone number and/or address, single letter spelling corrections. The latter has of course little bearing on the meaning of the text. Furthermore, corrections regarding tooth numbering or restoration type were found. The latter type of corrections are very important since they can directly influence the possibility to identify a person.

Conclusion

The quality of dental records can be improved, but identification of deceased persons based on dental characteristics was not hampered by the shortcomings revealed in this study.

References

1. Andersen L, Juul MN, Solheim T, Borrman H (1995) Odontological identification of fire victims – potentialities and limitations. *Int J Legal Med* 107: 229–234
2. Barsley RE (1993) Forensic and legal issues in oral diagnosis. In: Topics in oral diagnosis. *Dent Clin North Am* 37: 133–156
3. Borrman H, Taheri M, Woxberg B (1993). 27-Years of forensic odontology in Göteborg, Sweden. *Swed Dent J* 17: 249–253
4. Brown KA (1986) Forensic aspects of community dentistry. *Ann Acad Med Singapore* 15: 414–417
5. Eastwood BA, Fletcher J, Laird W (1984) The value of dental restorations in postmortem identification. *J Forensic Sci Soc* 24: 569–576
6. Goldman AD, Wright F (1991) Radiology. In: Averill DC (ed) *Manual of forensic odontology*, 2nd edn. Burlington, VT. Am Soc Forensic Odontol, pp 36–39
7. Gustafson G (1966) *Forensic odontology*. Staples, London, pp 32
8. Hill IR, Howell RD, Jarmulowicz M (1988) Identification in the Manchester air disaster. *Br Dent J* 165: 445–446
9. Keiser-Nielsen S (1980) Person identification by means of the teeth. A practical guide. Wright, Bristol, p 60
10. Knudson KG, Cottone JA (1984) Complete dental charting a medicolegal obligation. *Dent Stud* 62: 46–48
11. Rasmusson L, René N, Dahlbom U, Borrman H (1994) Quality evaluation of patient records in Swedish dental care. *Swed Dent J* 18: 233–241
12. René N (1988) Odontological liability in Sweden 1947–1983. (*Odontologiska ansvarsfrågor i Sverige 1947–1983*). Doctoral Thesis, University of Lund
13. René N, Öwall B (1991) Dental malpractice in Sweden. *J Law Ethics Dent* 4: 16–31
14. Solheim T, Stene-Johansen W, Lorentzen M, Sakshaug O (1989) The airplane accident in Torghatten on May 6, 1988. *Nor. Tannlaegeforen-Tid.* 99: 40–47
15. Solheim T, Lorentsen M, Sundnes PK, Bang G, Bremnes L (1992) The “Scandinavian Star” ferry disaster 1990 – a challenge to forensic odontology. *Int J Legal Med* 104: 339–345
16. Swedish National Board of Health and Welfare (SOSFS) (1993) Quality in health and medical care including dental care No. 9 (*Kvalitetssäkring i hälso-och sjukvården inklusive tandvård*)