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THE VALUE OF CERTAIN CHARACTERISTICS IN DENTAL IDENTIFICATION

by

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INTRODUCTION

Forensic dentistry can play a major rôle in the identification of bodies which have been extensively damaged by fire or putrefaction. This is due to the relatively high resistance of teeth. They often survive when all other parts of the body have been destroyed. Before positive identification can be made, however, adequate data on the dental conditions before the accident must be available.

The literature contains few studies of the value of the different characteristics in dental identification. As far as is known, only the Corsican dentist *Bonnafox* has attempted to establish the relative value of fillings in teeth for identification. Most writers have assumed that no two individuals have identical dentitions. This may well be true, but it is important to realize that two or more people may often have identical data in their dental records. There is no doubt that, under certain conditions, a number of persons can have similar fillings in the same teeth so that the dental records are identical.

This state of affairs is most likely to arise where a large number of people of the same age receive dental treatment from the

same dentist or from dentists with similar training. If these people are in one of the age groups in which the teeth have but few fillings, the risk of the dental records being identical is great. Caries produces a very uniform picture as the surfaces attacked in different mouths are the same. Certain tooth surfaces are very liable to be affected early by caries whereas others are much more resistant. This can readily be seen in a school-class of 13—14 year old children. The chances that there will be two or more dentitions with identical fillings, will be even greater if the children come from an area where, for reasons such as a high fluorine content in the drinking water, there is relatively little caries.

The object of the present study was to find out whether these difficulties do, in fact, exist to such an extent that identification from records of fillings is impossible. An attempt was also made to determine what additional information would be necessary to distinguish between people with identical fillings.

MATERIAL AND METHODS

The material, which was originally collected for a fluoridation survey (*Sellman, Syrrist & Gustafson, 1957*) consisted of 775 children aged 10—16 years and was distributed by sex and age as shown in Table 1.

Table 1

Years:	10	11	12	13	14	15	16	10--16
Boys	1	34	121	110	85	39	1	391
Girls	1	30	112	122	85	34	—	384
	2	64	233	232	170	73	1	775

The children came from three areas in southern Sweden, viz. 268 (35 %) from Simrishamn (S), 283 (36 %) from Åstorp (Å), and 224 (29 %) from Malmö (M). Both Simrishamn and Åstorp have a natural fluorine content of 1.3 p.p.m. in the drinking water while the water in Malmö contains only 0.3—0.5 p.p.m.F.

The children from Åstorp had all been treated by one dentist while those from Simrishamn and Malmö had been treated by several dentists.

The examination of the children was carried out in the Royal Dental School, Malmö by three investigators, (Sellman, Syrrist and Gustafson) independently. When the examinations were complete, the three examiners went over the records to reach an agreed average.

The following data were used in the present study:

1. Name, age, sex and record number.
2. The number, site, extent and material of all fillings.
3. The number of extracted teeth.
4. The number of sound teeth.
5. The number of unerupted teeth.
6. Deposits on teeth (black, brown, green and materia alba).
7. The gingival condition (gingivitis or normal gingivae).
8. Mottled teeth — presence or absence of mottling. The colour and extent of all mottled areas were noted.
9. Bite-wing radiographs.

Each tooth was represented on the record card by five squares corresponding to the mesial, occlusal, distal, buccal, and lingual surfaces. Incisor teeth were represented by four squares.

Treatment in the school dental service in Sweden is relatively uniform. As amalgam and silicate cements were almost the only filling materials used, and as there is a standard preparation technique, a simple Moulage system was used for registration.

Fig. 1 shows how the site and extent of the most common fillings are recorded in the Moulage system with a number and a letter. The number indicates the type (site) of the filling. The letters a and s indicate its material amalgam resp. silicate. Thus, 3a is an occlusal amalgam filling, 5a and 6a are occlusal amalgam fillings combined with a single or with double proximal fillings, while 7s is a silicate filling mesially or distally in an anterior tooth. Two amalgam fillings in the same tooth are written 1a, 2a where one (1a) is a pit-filling in one fossa while the other (2a) is a filling extending from the other fossa into the adjacent fissure without extending through the ridge between the fossae.

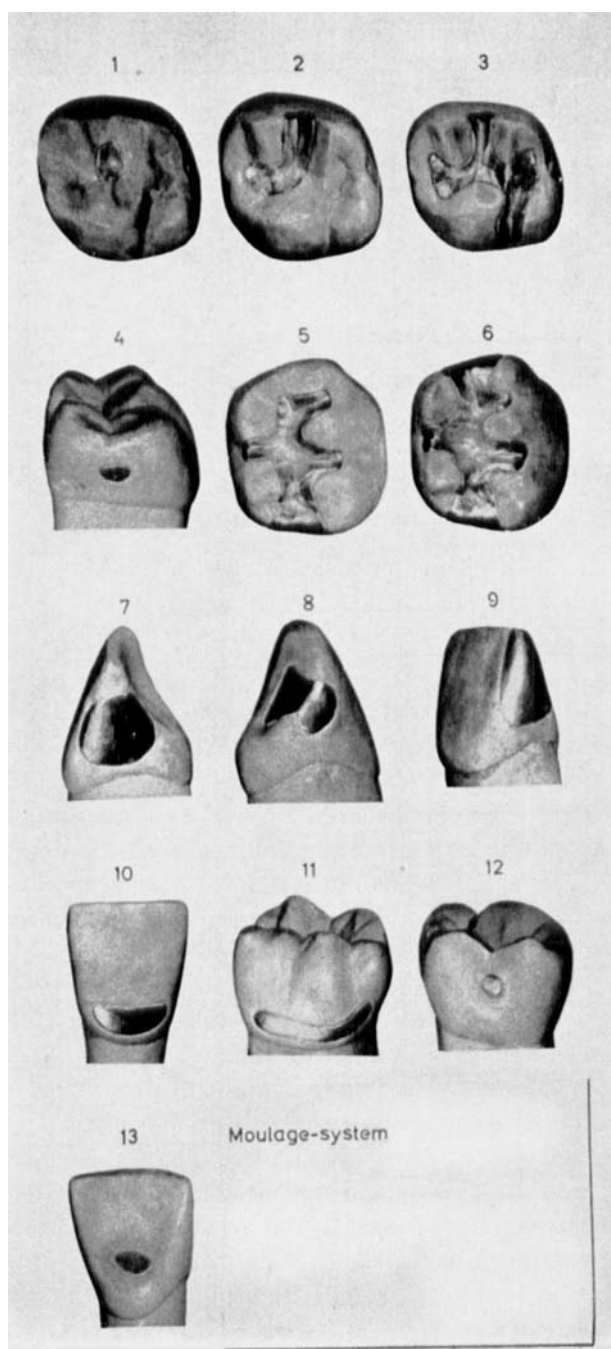


Fig. 1.

This method of registration gives a large number of possible combinations without the necessity of drawing in each filling on the chart. Drawing in each filling will, of course, illustrate its appearance and site more accurately but, for investigations of large numbers of people, the present method is less time-consuming, easier for comparison of individuals and sufficiently accurate for its purpose.

RESULTS

It was not possible to make a direct rapid comparison between individuals because of the large number examined. A system of allocating the cards to different groups, within which comparisons could more readily be made, was therefore essential. The system which was adopted had, as its basis, the number of fillings in the upper and lower jaws.

The code number of each child, the sex, and the number and sites of filled surfaces, were noted on a card (Table 2). The numbers of filled surfaces in the upper, UJ (9 fillings) and lower, LJ (10 fillings) jaws were noted. It is thus possible to select groups of children such as, for instance, those who have 9 fillings in the upper jaw and 10 in the lower jaw.

One of the largest groups consisted of children who had two fillings in the upper jaw and four in the lower jaw. Subgroups could be made up with, for instance, children who had these two upper fillings on the same tooth surface or who had the two lower fillings on the same surface (Table 3). Further subdivision is, however, impossible if only filled surfaces are taken into account. Thus, for example, all the children numbered 267, 235, 80, and 860 have filled surfaces which are identical as far as position and distribution are concerned. Numbers 267 and 235, however, are boys while 80 and 860 are girls. There are thus two boys with occlusal fillings in their 6+*) and +6, and occlusal and buccal fillings in their 6- and -6. The Moulage notation

*) According to the Haderup dental stenography, + denotes the upper jaw, — the lower jaw. When the sign is placed to the right of the figure, the right side tooth is indicated and *vice versa*.

right									left									
8	7	6	5	4	3	2	1	+	1	2	3	4	5	6	7	8	upper jaw	
8	7	6	5	4	3	2	1	—	1	2	3	4	5	6	7	8	lower jaw	

Table 2

			7+, 7—	6+, 6—	5+, 5—	4+, 4—	3+, 3—	2+, 2—
			m o d	b m o d	b m o d	b m o d	b m d	b m d b
341 ¹	UJ ³	9 ⁵		x x	x x	x x		x
Male ²	LJ ⁴	10 ⁵	x	x x				

¹ Registration number. ² Sex. ³ Upper jaw.

(Table 3, lower part) is the same in each boy for the fillings in their +6 (2a, 2a), and in their 6— and —6 (both 3a, 12a). Boy number 267 has occlusal fillings (2a, 2a) in his 6+, however, while boy number 235 has also occlusal fillings in his 6+ but a different combination (2a, 1a). These two boys can thus be distinguished from one another with the help of the Moulage system.

The Moulage annotation for the two girls is also given in Table 3. Here too the children differ. No. 80 has two separate

Table 3

			7+ 7—	6+ 6—				+6 —6	+7 —7
			m o d	b m o d				m o d	b m o d b
267	UJ 2			x				x	
♂	LJ 4			x x				x x	
235	UJ 2			x				x	
♂	LJ 4			x x				x x	
80	UJ 2			x				x	
♀	LJ 4			x x				x x	
860	UJ 2			x				x	
♀	LJ 4			x x				x x	
267	UJ			2a, 2a				2a, 2a	
♂	LJ			3a, 12a				3a, 12a	
235	UJ			2a, 1a				2a, 2a	
♂	LJ			3a, 12a				3a, 12a	
80	UJ			3a				2a, 2a	
♀	LJ			3a, 12a				3a, 12a	
860	UJ			3a				3a	
♀	LJ			3a, 12a				3a, 12a	

UJ = upper jaw

LJ = lower jaw

+1, -1		+1, -1		+2, -2		+3, -3		+4, -4		+5, -5		+6, -6		+7, -7	
m	d	b	m	d	b	m	d	b	m	d	b	m	d	b	m
	x											x			
										x	x	x	x	x	x

⁴ Lower jaw. ⁵ Number of fillings.

fillings (2a, 2a) in her +6, while no. 860 has a single filling (3a) in the corresponding tooth.

Another group of 4 children (all boys) is shown in Table 4. Although all have the same number of fillings (UJ 2 + LJ 4), they can be distinguished from one another by the sites of the fillings in the lower teeth.

Lingual fillings, which were noted on the original forms, were not included on the group cards as they were relatively rare in

Table 4

7+ 7-		6+ 6-		+6 -6		+7 -7	
m	o	d	b	m	o	d	b
...				...			
639 UJ 2			x		x		
♂ LJ 4			x	x		x	
465 UJ 2			x		x		
♂ LJ 4			x	x		x	
606 UJ 2			x		x		
♂ LJ 4			x	x			x
668 UJ 2			x		x		
♂ LJ 4	x		x		x		x
639 UJ			2a, 2a		2a, 2a		
♂ LJ			5a		3a, 12a		
465 UJ			2a, 2a		1a		
♂ LJ			1a, 1a, 12a		2a, 2a, 12a		
606 UJ			2a, 2a		3a		
♂ LJ			3a, 12a		3a		3a
668 UJ			3a		3a		
♂ LJ		3a	3a		3a		3a

UJ = upper jaw

LJ = lower jaw

the age groups concerned. They are, however, included in the Moulage code and can of course be used for identification.

Since all the information was entered on cards, a preliminary grouping of the children could be made on the basis of the number of fillings in the upper jaw. Subgroups were then formed from those with the same combinations of fillings in both jaws (e.g. two fillings in the upper and four in the lower jaw).

Of the total of 775 children (Table 5) 611 had fillings or combinations of fillings which were not present in any other child. They could all be identified solely on the basis of the number and sites (surfaces) of their fillings. Of the 268 children from Simrishamn, 85 or 32 % had similar fillings while only 9 % of the Malmö children were alike in this respect. This difference is probably due to the difference in caries prevalence (9.4 DMF resp. 16.9).

Table 5

Locality	No similarity	Similarity	Total Material
Simrishamn	183	85 32%	268
Malmö	205	19 9%	224
Åstorp	223	60 21%	283
All	611	164	775

The remaining 164 children were divided into 21 groups, each with a different combination of fillings (Table 6). It can be seen from Table 6 that all the children with similar fillings have less than 8 fillings in their upper teeth. In the age group of this study, the most common combination was 2 fillings in the upper teeth with 2, 3, or 4 fillings in the lower teeth. Approximately 12 % of the 775 children had these three combinations. A total of 57 % of the 164 children with uniform fillings were in these three groups.

Table 6

UJ	0	0	0	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	6	7
LJ	0	2	3	4	0	1	2	4	0	1	2	3	4	2	3	4	8	2	3	6	4
S	2	1	3	3	1	1	—	—	2	1	—	28	11	21	3	3	—	—	3	1	1
M	—	—	—	—	—	—	—	—	—	—	—	4	3	7	—	—	—	1	1	1	1
Å	7	7	—	3	1	1	4	3	2	3	5	5	9	2	2	2	1	2	—	—	1
	9	8	3	6	2	2	4	5	3	3	37	19	37	5	5	2	2	6	2	2	2

UJ = upper jaw
LJ = lower jaw

S = Simrishamn
M = Malmö
Å = Åstorp

= 85 52%
= 19 12%
= 60 36%
= 164

If the sex and number, site and material of the fillings is all that is noted on the dental record cards of children of this age, only 83 % of them can be positively identified. The remaining 127 children can then be divided into 24 groups containing from 2 to 25 children with the above features in common (Table 7).

Table 7

UJ	$\frac{0}{2}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{0}{2}$	$\frac{0}{3}$	$\frac{0}{4}$	$\frac{0}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{2}{1}$	$\frac{2}{2}$	
LJ	$\frac{0}{2}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{0}{2}$	$\frac{0}{3}$	$\frac{0}{4}$	$\frac{0}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{2}{1}$	$\frac{2}{2}$	
Boys	6	3	2			4	2			2		= 19
Girls	3			2	2			3	2		8	= 20

UJ	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{4}$	$\frac{2}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{4}$	
LJ	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{4}$	$\frac{2}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{4}$	
Boys	25	2			4	18	2	4		2	2	= 59 + 19 = 78
Girls		7	3		17			2				= 29 + 20 = 49
												127

UJ = upper jaw

LJ = lower jaw

The children in these 24 groups could, however, be distinguished from each other by the more exact definition of their extent seen on the cards presented in Table 2, but even with this 67 children in 4 combination groups remained (Table 8).

Table 8

Locality	♂ 2/2	♂ 2/3	♂ 2/4	♀ 2/4	Total	
Simrishamn	18	3	12	9	42	63%
Malmö	3	1	3	3	10	15%
Åstorp	4	3	3	5	15	22%
All	25	7	18	17	67	

It is interesting that 63 % of these children came from Simrishamn, 22 % from Åstorp (both areas with a water supply with a high fluorine content), while only 15 % came from Malmö. These 42 children from Simrishamn comprised 16 % of the total from Simrishamn (268) while only 4 % of the Malmö children (224) had similar fillings. This is probably due to the considerably higher caries prevalence in Malmö (*Sellman, Syrrist & Gustafson, 1957*).

Identification by means of additional data

Further identification could be made with the additional information on the dental record cards. For easier comparison a diagram (Fig. 2) was used for the different items of information on the cards. Each square corresponds to a child and the height of the column illustrates the number of children in the group.

The 4 groups were:

	UJ	LJ
25 boys with combination	2	2
7 " " "	2	3
18 " " "	2	4
17 girls " "	2	4

In each column a discrimination is made on the basis of the following characteristics.

The columns in Fig. 2 show:

- I. Special position of fillings (not included in the card Table 2).
- II. Extracted teeth.
- III. The Moulage notation of the fillings.
- IV. Presence of deposits on the teeth.
- V. Gingival pathology.
- VI. Mottled teeth.
- VII. Unerupted teeth.

An attempt first to subdivide the groups on the basis of the presence or absence of *lingual fillings* (without using their

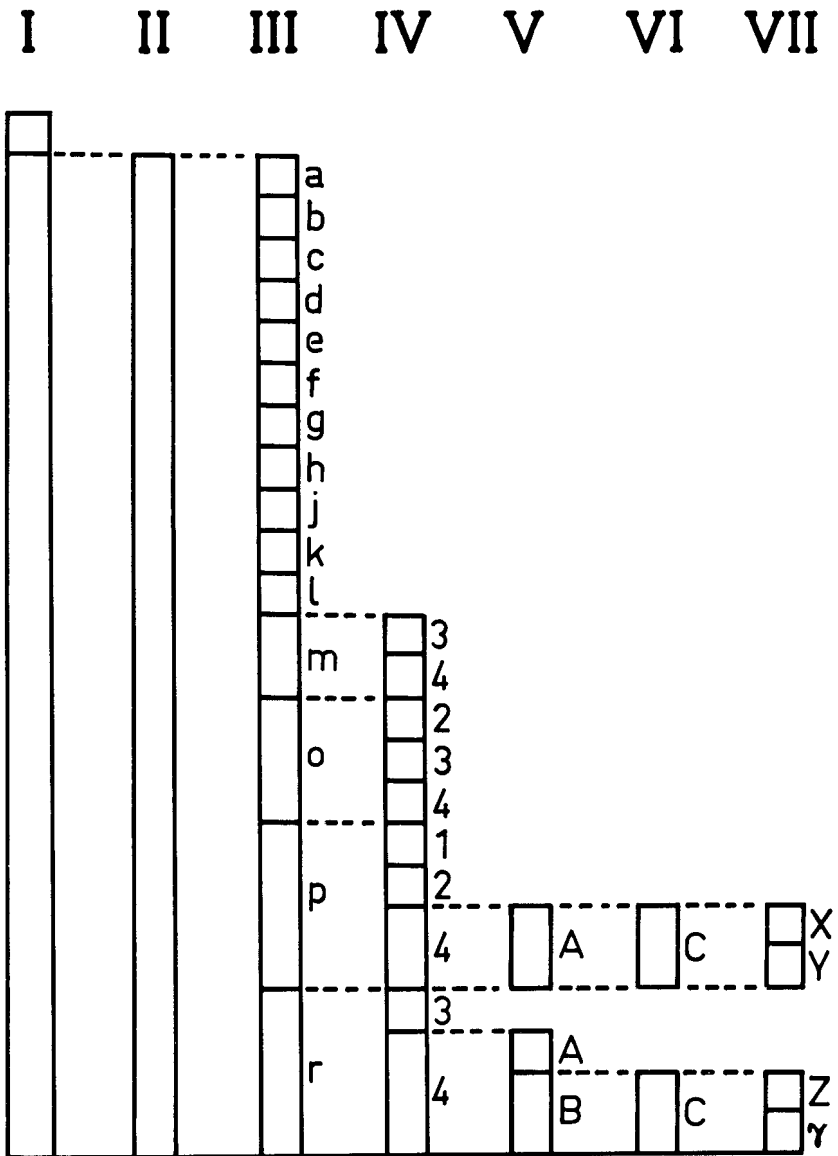


Fig. 2.

Moulage notation) was successful in only two cases. Only one of the boys with 2/2 (Fig. 21) fillings could be identified in this way as he had a lingual filling in 6+ while none of the other boys in the group had such a filling. Three of the boys in the

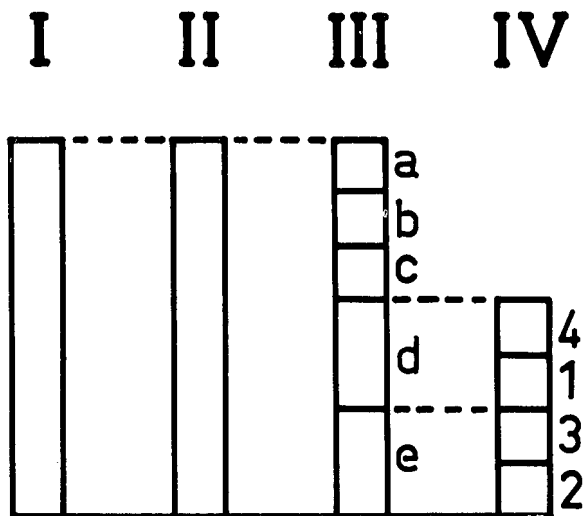


Fig. 3

2/4 group (Fig. 4), and one of the girls in the 2/4 group (Fig. 5) could be identified as they had different lingual or palatal fillings.

No further identification was possible from column II - - *extracted teeth* in any of the groups.

The exact positions of the fillings in the teeth were shown by the Moulage system. It can be seen from column III in Fig. 2 how this system breaks down the group.

Thus 11 boys (a—l) could be identified from the 2/2 group (Fig. 2) leaving 4 groups; one group (m) with 2 boys, another (o) with 3, a third (p) with 4 and a fourth group (r) also with 4 boys.

In the group of boys with combination 2/3 (Fig. 3) there were two boys with combination d (fillings 3a; 3a; 3a; 12a) and two with combination e (2a, 2a; 2a, 2a; 3a; 3a; 12a).

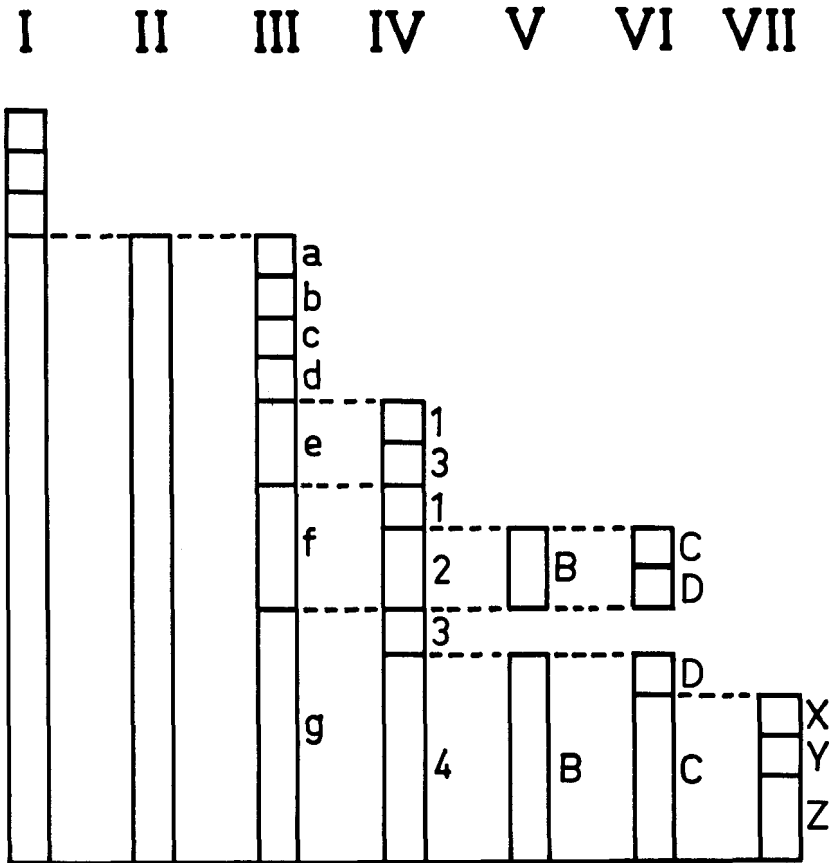


Fig. 4.

In the 2/4 boys' group (Fig. 4) four boys (a—d) could be positively identified by means of the Moulage system. There then remained three groups with 2 boys in one group (e), 3 in another (f) and 6 in the third (g).

5 girls (a—e) in the 2/4 girls' group (Fig. 5) could be positively identified by means of the Moulage system and the remainder divided into four groups, three of them with 2 (f, g & h) and the fourth with 5 (j) girls.

Thus if only the sex of the child, and the numbers, sites and Moulage system notations of the fillings were used, 39 children

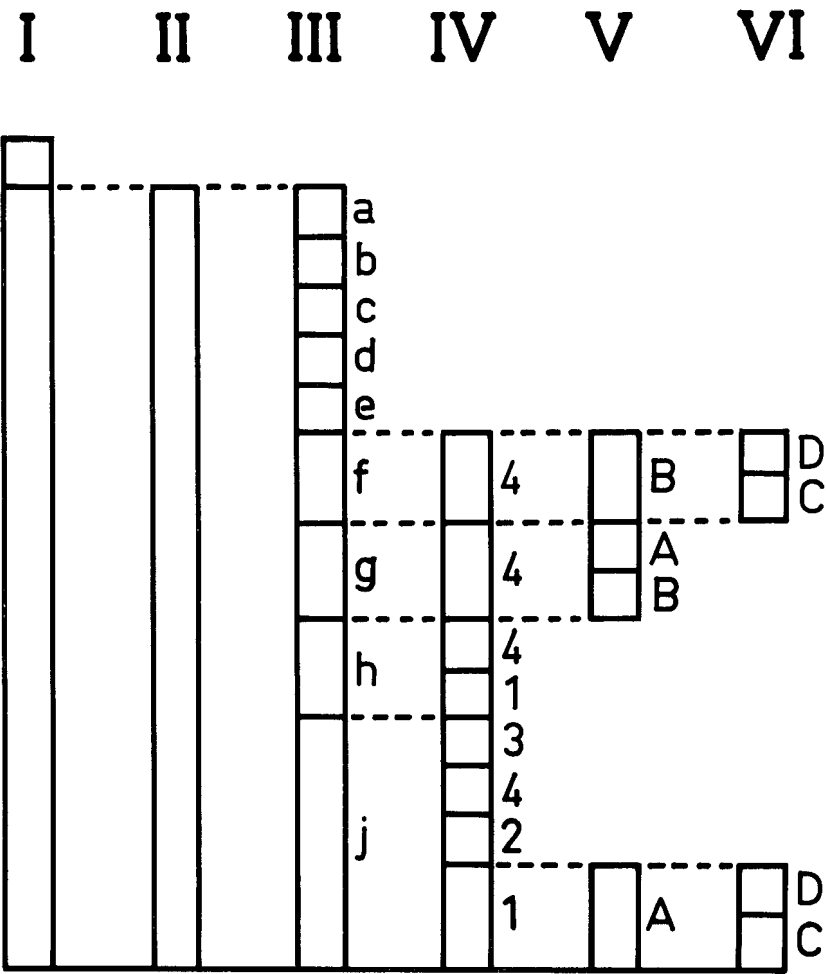


Fig. 5.

could not be positively identified. Each of these 39 children had at least one of his or her fellows with the same sex and filling pattern.

The *presence, colour, and type of deposits on the teeth* (IV) were also noted on the dental record cards. Four types could readily be distinguished from one another; green, brown and

black stains and *materia alba*. A fifth group had no deposits of any kind.

In the 2/2 boys' group (Fig. 2), 8 could be identified by the deposits on their teeth leaving two subgroups, one with 2 and the other with 3 boys.

The remaining 4 boys in the 2/3 group (Fig. 3) were all different with respect to deposits. One had green, one black, and one brown stain and one had no deposits at all. Thus all boys in this group could be positively identified when presence and type of deposits were added to the original data.

In the 2/4 girls' group (Fig. 5), 5 children could be identified with the help of their deposits. There then remained 5 without deposits in one group and 2 with black deposits in another.

In the 2/4 girls' group (Fig. 5), five children could be identified by the colour of the deposits on their teeth. This left three groups, each of two children.

Thus, even when the colour and type of deposits on the teeth had been used to aid identification, there remained 18 uniform children.

The *condition of the gingivae* (V) had been noted on the dental record cards in that the presence or absence of gingivitis had been recorded. With this additional information, one of the boys in the 2/2 boys' group (Fig. 2) and 2 girls in the 2/4 girls' group (Fig. 5) could be positively identified.

The next factor was the presence and extent of *dental fluorosis* (VI). None of the boys in the 2/2 boys' group (Fig. 2) exhibited fluorosis, but 3 boys in the 2/4 boys' group (Fig. 4) could be identified by its presence. At this stage two groups each of two identical boys (Fig. 2) and one group of four identical boys (Fig. 4) remained.

No girls were left as the last 4 in the 2/4 group were identified by means of their fluorosed teeth.

If the *unerupted teeth* (VII) were taken into account, the remaining 4 boys in the 2/2 group (Fig. 2) could be identified, as could 2 of the 2/4 group (Fig. 4). Thus, only 2 remained unidentified (Fig. 4, Z).

The use of unerupted teeth as a distinguishing feature is, how-

ever, of doubtful value as changes are bound to occur with time. The reliability of this factor is naturally directly dependent on the amount of time which has elapsed between the dental examination and the accident.

The use of radiographs in identification

Of the various types of information recorded at the dental examination, only the bite-wing radiographs have not yet been utilized. They were not examined until the various stages described above had been completed, because the object of this study was to assess the value of the types of information which are most commonly available. The radiographs of the two children who could not previously be distinguished from one another were therefore examined (Fig. 6). The fillings in each were so different in shape, in spite of the Moulage notations being identical, that there was no possibility of confusion. Thus, identification could be completed when radiographs were available.

DISCUSSION

If the type of filling material and the filled tooth surfaces is all that is marked on the dental charts, positive identification of 10--16 year-old children is very difficult. If the sites of the fillings are also known, the difficulties are reduced, although four groups totalling 67 children remained in the present study of 775 children aged 10--16.

The Moulage notations of the fillings are of great additional

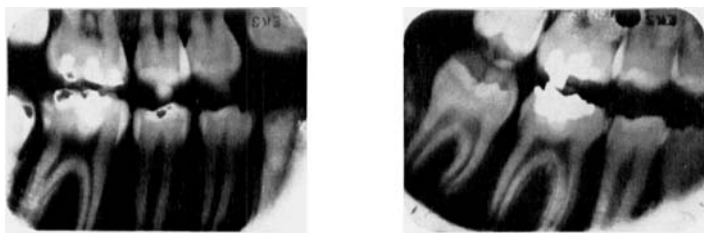


Fig. 6.

value although, even when these were used, 39 of the present series remained unidentified.

It is evident, therefore, that the recording of treated teeth does not allow positive identification in every case. If, for instance, a group of children died in a bus accident followed by fire, positive identification of every child might be impossible if additional information were not available.

Where the sites and extent of the fillings are known, and especially where their Moulage notations or drawings of their outlines are available, the possibilities of positive identification are greatly increased (*Gustafson & Johanson, 1959*).

The other data which were used in the present study are, unfortunately, not reliable. Deposits on the teeth and the condition of the gingivae can change in a relatively short period of time as a result of alterations in the diet or in the standard of oral hygiene. There is, however, no doubt that information of this type is of considerable value in cases where identity is uncertain.

The value of radiographs will not be considered here as we hope to deal with this subject in a future paper reporting an extension of the present study.

The sites of fillings

Since the occurrence of the various types of fillings is of major importance in dental identification, this was studied in the present material.

As would be expected, there was a considerable degree of similarity between different individuals both as regards sites and extent of fillings. This is almost certainly due to the well-known order of susceptibility of different teeth to caries.

A total of 751 (96 %) of the present series of children had occlusal amalgam fillings in both lower first molars while 696 (90 %) had occlusal amalgam fillings in all four first molars.

The curves in Fig. 7 show how the fillings were distributed. The curve representing the upper jaw (dotted line) reaches its maximum at 161 children who have two fillings and gradually drops to groups with more fillings. In all of the 161 children who

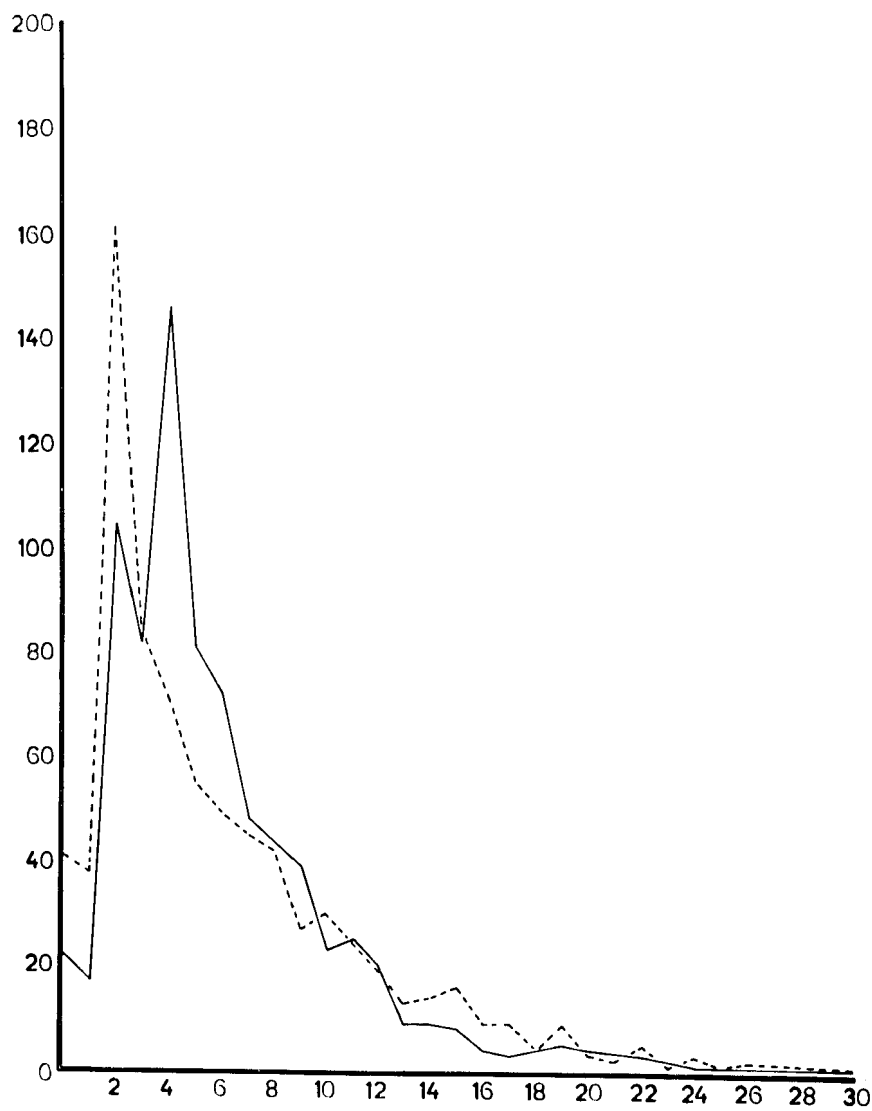


Fig. 7.

had two fillings, it was the occlusal surfaces of first molars which were filled.

In all of the 84 children who had three fillings in their upper teeth, it was again only the first molars which were involved although they now also had buccal or mesial fillings.

The corresponding curve for the lower jaw (Fig. 7) reaches a peak representing a group of 105 children with two fillings. It then drops to the group of 83 with three fillings only to rise again to the largest group of 146 children with four fillings.

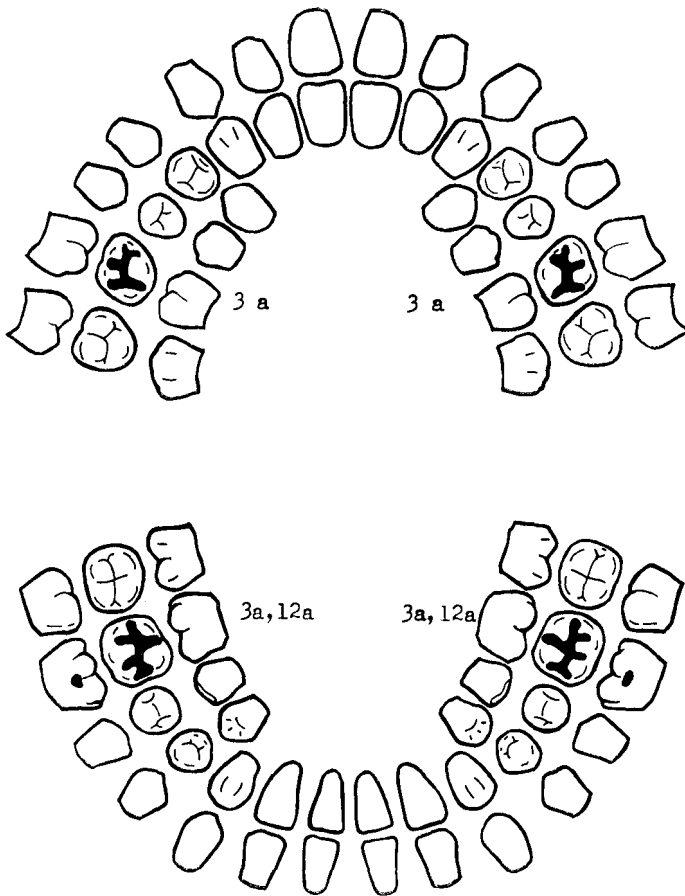


Fig. 8.

Unlike conditions in the upper jaw, up to four fillings are usually present in the lower jaw without involving any more teeth than the first molars. This is due to the high incidence of buccal fillings in lower first molars.

It would be very useful if the incidence of different combinations of fillings were known. It would then be possible to say whether or not any particular combination was sufficiently unusual to allow positive identification on its own. Positive identification in this way is obviously possible. We have, however,

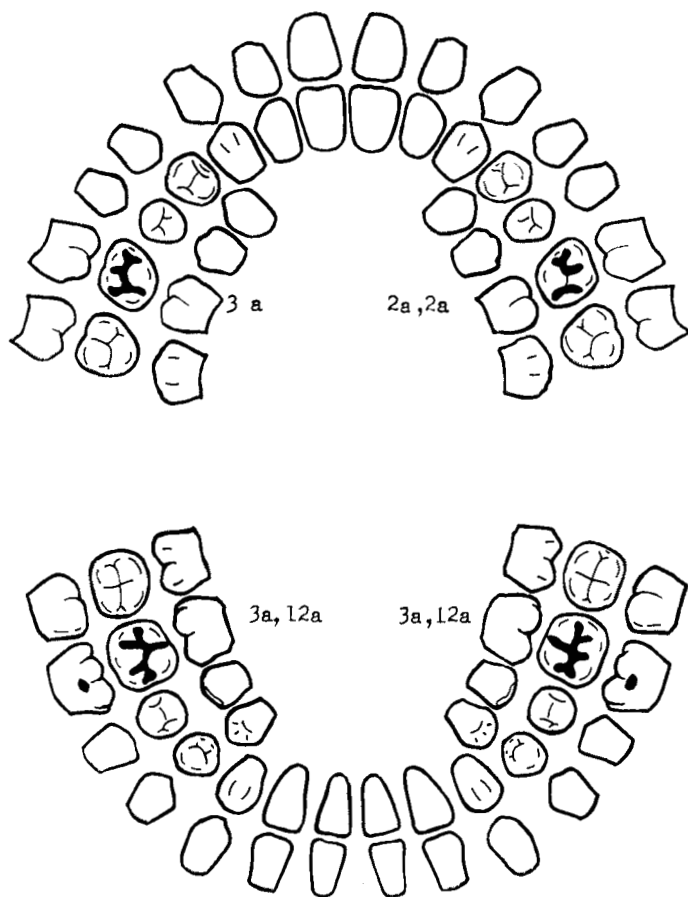


Fig. 9.

shown that, in combination 2/2 (Moulage notation), the usual method of recording fillings gave a total of 24 children with identical records. Where the only available record is that of filled teeth, identification is almost impossible. Yet this type of record is all that is kept by many dentists.

The sites of the most common types of fillings in the present material were calculated and are shown diagrammatically in Figures 8, 9 and 10. These figures show the combinations of fillings which thus are least reliable for identification.

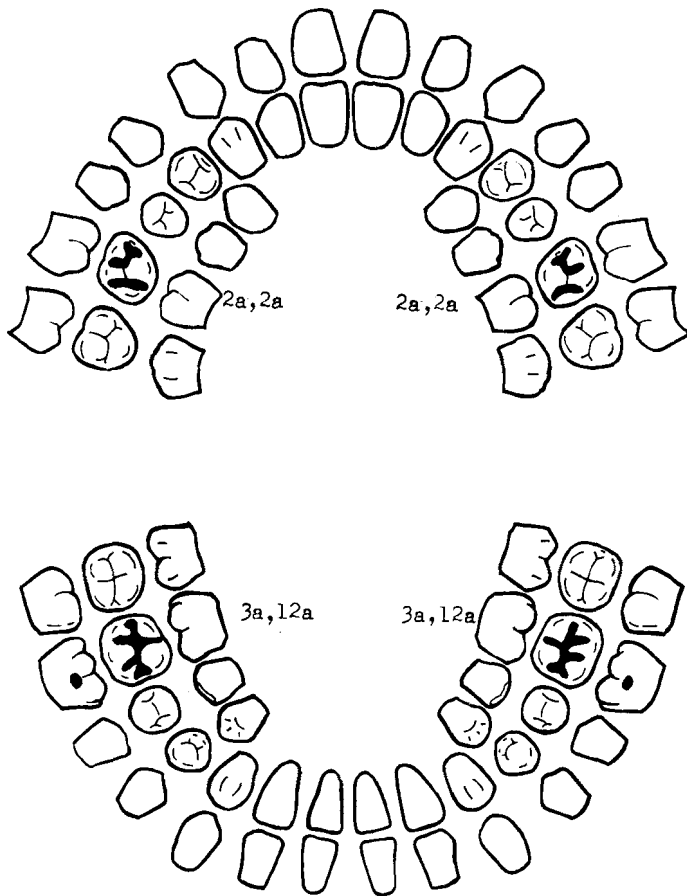


Fig. 10.

It is highly desirable that routine dental records should be more comprehensive than they are at present and include either a description of the sites and extent of the fillings or each filling should have a numerical notation of the type used by *Sellman, Syrrist & Gustafson* (1957). Best of all, however, would be careful drawings of the sites and extent of the fillings.

SUMMARY

The value of several different dental criteria in identifying young individuals of approximately 13 years of age has been investigated.

Among 775 children, a large number (164) showed identical filling patterns when only the tooth surfaces were considered. It is therefore impossible to differentiate between a considerable number of school children in this age group without employing additional criteria. The influence of a number of such criteria is reviewed.

After discussing the usual distribution of fillings, their relative frequency of occurrence has been calculated. It is concluded that considerable difficulties may arise in the process of identifying young teenagers after an accident in which the more common-place features have been destroyed.

RÉSUMÉ

LA CONFIANCE À ACCORDER À L'IDENTIFICATION PAR LES DENTS

Les auteurs ont examiné la confiance à accorder à l'identification de jeunes individus âgés d'environ 13 ans par l'utilisation de différents critères dentaires.

Parmi 775 enfants, un grand nombre (164) présentaient des obturations d'aspect identique lorsqu'on ne considère que les surfaces dentaires. Il est donc impossible de reconnaître les différences entre un nombre considérable d'écolier de cet âge sans recourir à des critères supplémentaires. L'influence d'un certain nombre de ces critères est examinée.

Après une discussion sur la distribution habituelle des obturations, leur fréquence relative a été calculée. Les auteurs concluent

que l'identification de jeunes adolescents après un accident peut présenter des difficultés considérables si les particularités plus ordinaires ont été détruites.

ZUSAMMENFASSUNG

DIE ZUVERLÄSSIGKEIT DENTALER IDENTIFIKATION

Eine Untersuchung wurde an einer grossen Anzahl (775) von Kindern im Alter von ungefähr 13 Jahren ausgeführt. Man konnte feststellen, dass grosse Schwierigkeiten entstehen, wenn Kinder dieses Alters identifiziert werden sollen und dies besonders, wenn die Gesichtszüge zum grössten Teil zerstört worden sind. An Hand von Füllungen allein ist es nicht möglich eine Identifizierung auszuführen, weil in einer Gruppe von 15 bis 25 Kindern sich mehrere befinden, die genau dasselbe Zahnschema aufweisen. Nur wenn zusätzliche Merkmale verwendet wurden, war es möglich alle Kinder in dieser Untersuchung voneinander zu unterscheiden. Es war möglich die gewöhnlichsten Füllungskombinationen zu berechnen und zu beurteilen.

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