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TECHNICAL NOTE

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A new technique for the postmortem detection of tooth-coloured dental restorations

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Abstract Identification of unknown bodies is mainly made by dental examination and comparison with accurate dental records. Therefore it is necessary to examine the jaws carefully and to locate every tooth-coloured dental restoration. Overlooking dental fillings can make positive identification impossible. The technique described prepares the natural dental hard tissue by etching with 37% phosphoric acid. In the next step an indicator colours the roughened dental tissue but not the polished restoration material. In this way all 15 tested dental restoration materials could be detected with high sensitivity.

Key words Identification · Tooth-coloured dental fillings · Dental records · Forensic odontology · Dental examination

Introduction

Brown [3] described the following case in 1982: On September 1, 1934, the partly burned body of a young woman was found in Albury, Australia. Since the body was assumed to be that of Linda Agostini, who had been missing for several weeks, the examination team consulted her dentist. The dentist explained that he had performed eight dental fillings. Since the coroners could only find six fillings, identification was negative. Two tooth-coloured fillings had been overlooked and were first discovered by two new examiners in 1944. The husband, confronted with the positive identification, admitted that he had killed his wife 10 years previously.

Since 1934 the constant improvement of dental materials has increased the risk of overlooking natural-coloured dental restorations. Therefore a new "Linda Agostini" case is now more likely than 50 years ago. We have elaborated a new method for clear identification of such restorations and fillings.

Identification of unknown bodies depends on dental examination and accurate dental records [1, 2, 6–9, 14, 15]. The detailed charting of all restorations is of great importance for comparison of missing persons and postmortem dental findings. Failure to notice restorations can make positive identification impossible. The individual specificity of dental fillings is based on individual geometric forms of restorations and caries cavities [6, 8, 14, 16].

Detection of silver-amalgam and gold restorations presents little difficulty to the forensic odontologist [4], but anterior restorations are normally tooth-coloured. New composite, compomere and ceramic filling materials imitate the natural hard tissue as perfectly as possible in pigmentation and translumination. This effect is increased by a covering of saliva. With the improvement in dental fill-

Table 1 Overview of all tested dental filling materials

	Filling material	Manufacturer
Composite (acrylate filling materials)	Arabesc	Voco
	Z-100	3M
	Charisma Single Dose	Kulzer
	Alphaplast	DMG
	Compoglass	Vivadent
	Durafill	Kulzer
	Dyract	De Trey
	Heliomolar	Vivadent
	Helio Progress	Vivadent
	Herculite XRV	Kerr
	Pekafill NF	Bayer Dental
Plastic fissure sealant	Helio Seal	Vivadent
Glasionomer cement (aluminium-silicate-polyacrylic acid cement)	Ketac Fill	Espe
	Chem Fil Superior	De Trey
Ceramic	In – Ceram	Vita

Dedicated to Prof. Dr. G. Reinhardt on the occasion of his 65th anniversery

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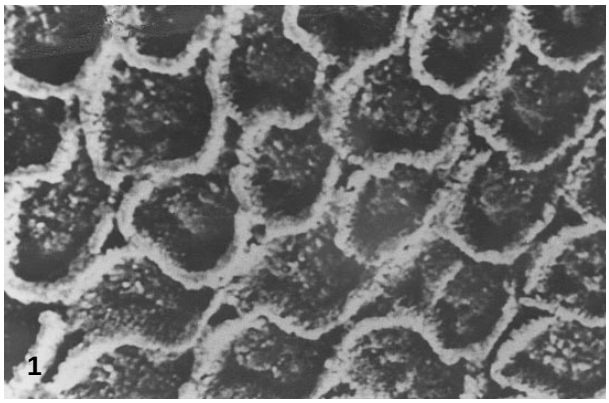

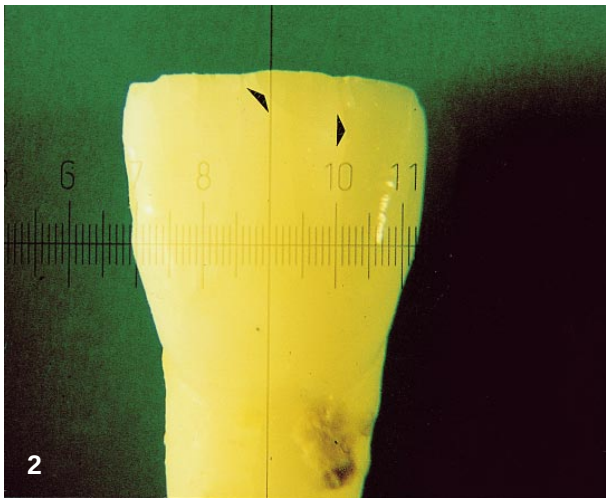

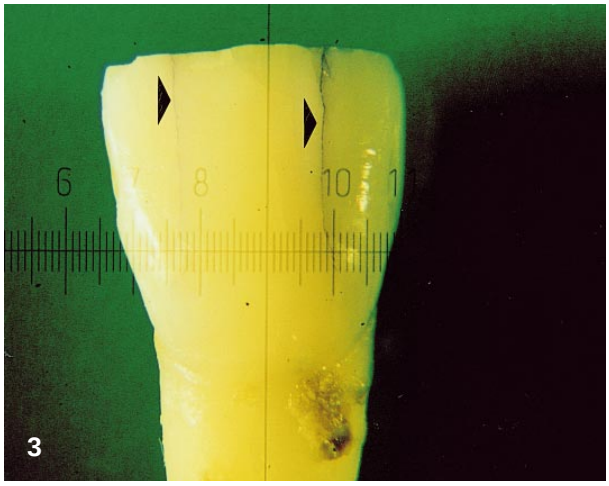

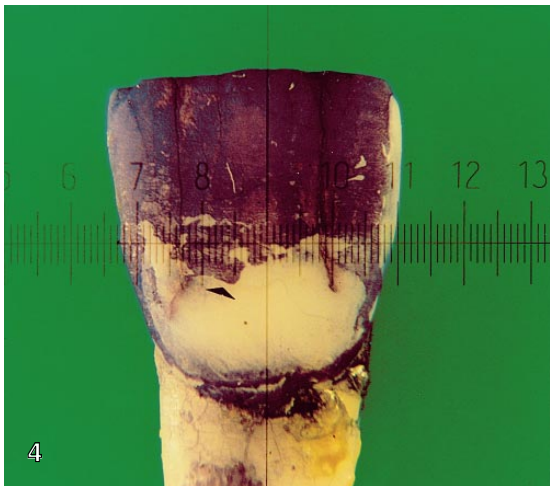

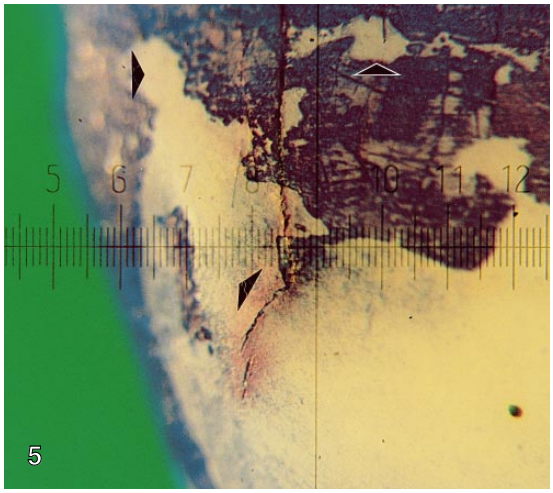

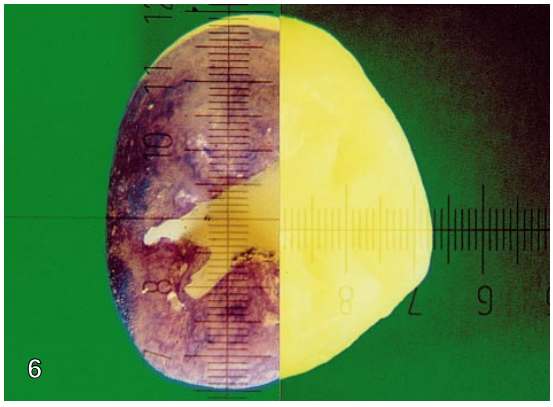

Fig. 1 Retentive etching pattern of 300–500 µm depth (SEM 360 ×)

Fig. 2 The buccal surface of a left upper incisor with several slits (*arrowheads*). Are they slits of a natural-coloured dental filling or enamel crevices?

Fig. 3 The same tooth coloured with benzalkonium chloride and ink as described in old techniques. A lot of dye penetrates into the slit

Fig. 4 The same tooth after preparation with phosphoric acid for 120 s and application of ink. The boundary of the restoration is clear-cut. There is no confusion between the enamel crevice in the middle and the slit of the restoration (*arrowhead*)

Fig. 5 Bonding remnants (*arrowheads*) in masticatory areas after laying an acrylic restoration. These acrylic remains can give an indication of the person's last dental treatment

Fig. 6 Plastic fissure sealant before (*right*) and after (*left*) detection with the new technique

ing materials, posterior restorations are also increasingly naturally coloured.

Even if the dentist has access to special equipment such as probes, optimal lighting and compressed air, it can be difficult to reliably recognize tooth-coloured and perfectly polished restorations. At autopsy the conditions are often more unfavourable because of the presence of blood and stomach contents, putrefaction and its products [12]. Since poor lighting and covering by blood and debris may mask the synthetic fillings, these can easily be overlooked and even a ceramic crown can be missed.

Only a small number of authors have described methods for detection of tooth-coloured restorations. Clark and Ruddick [4] recommended ultraviolet radiation with a peak emission at λ = 365 nm. Whittaker and McDonald [18], Stimpson [17] and Midda [12] used dyes that penetrate the restoration slits forming the boundary of the restoration. The dye techniques are based on a discrepancy and the existence of a gap between the filling material and the hard tissue cavity. The absence of a gap means that detection is not possible; therefore, perfectly polished and well placed fillings cannot be recognized.

Material and methods

The technique was tested in situ and with isolated jaws during forensic autopsies. Moreover, teeth extracted for orthodontic purposes were prepared with a single and a two-surface cavity. Each tooth was filled with a different currently available composite or plastic fissure sealant [5, 13] (Table 1).

Our approach consisted of two steps:

1. After cleaning the teeth with water and toothbrush, the whole clinical crown was etched with 37% phosphoric acid for 120 s. The acid was absorbed in a gel of high viscosity. The acid was applied with a syringe. This technique enabled the examiner to place the acid correctly in the oral cavity. Resected jaws can be flooded with acid in a beaker. After 120 s the teeth are cleaned with water and dried with gauze. Only the enamel becomes roughened, and a retentive etching pattern of 300–500 µm depth results (Fig. 1).

2. In a second step the teeth were covered with blue ink as an indicator. The ink was also applied with a syringe. After the indicator reacted for 120 s the surplus was removed by water spray.

Results and discussion

The postmortem detection is an indirect procedure that stains the enamel surrounding a restoration. Since the roughness of the dental filling materials is minimal, the ink runs off them, but penetrates into the roughened natural hard tissue.

Using the described technique, 15 different filling materials could readily be recognized (Fig. 4). The sensitivity of the method was also high enough to detect very small acrylic inserts, called bonding, which are used during the preparation for composite dental fillings (Fig. 5). According to Lutz and Meier [11], it must be assumed that these bonding remains are damaged by abrasion and attrition during mastication over a period of 4 months. Detection of such small acrylic remains can give an indication of the person's last dental treatment.

Plastic fissure sealants are used in caries prophylaxis. Jakobsen et al. [10] published a forensic case in which the detection of such fissure sealants by scanning electron microscopy (SEM) was the only aid to positive identification. The technique described in this paper is sensitive enough to detect these fissure sealants and suggests a practical alternative to SEM detection (Fig. 6).

The new technique also permits ready discrimination between an enamel crevice and a gap in a restoration (Fig. 2, 3, 4).

All teeth can be etched and stained by this method. Contrast differences are based on individual differences in crystallization of the enamel prism. Chemical burns or soiling of the face did not occur. The handling is not dangerous to the investigator. The technique is cheap and can be a further aid for all examiners – dentists or non-dentists – who are confronted with dental examination in forensic practice.

References

1. Andersen L, Juhl M, Sohlheim T, Borrmann H (1995) Odontological identification of fire victims – potentialities and limitations. Int J Leg Med 107:229–234
2. Borrmann H, Dahlbom U, Loyola E, René N (1995) Quality evaluation of 10 years patient records in forensic ondontology. Int J Legal Med 108:100–104
3. Brown KA (1982) The identification of Linda Agostini. Am J Forensic Med Pathol 3:131–141
4. Clark DH, Ruddick RF (1985) Post mortem detection of tooth coloured dental restorations by ultra violet radiation. Acta Med Leg Soc (Liege) 35:278–284
5. Eichner K, Kappert HF (1996) Zahnärztliche Werkstoffkunde und ihre Verarbeitung. Hüthig, Heidelberg, pp 206–372
6. Endris R (1979) Praktische forensische Odonto-Stomatologie: das Gebiss als Indiz und Tatwerkzeug. Kriminalistik, Heidelberg
7. Endris R (1982) Forensische Katastrophenmedizin. Kriminalistik, Heidelberg
8. Gustafson G (1966) Forensic odontology. Staples Press, London
9. Hunger H, Leopold D (1978) Identifikation. Barth, Leipzig
10. Jakobsen J, Holmen L, Fredebo L, Sejrsen B (1995) Scanning electron microscopy, a useful tool in forensic dental work. Paper read at the 13th Meeting of IAFS, Düsseldorf, Germany, 1993. J Forensic Odontostomatol 13:36–40
11. Meier C, Lutz F (1979) Komposits kontra Amalgam: vergleichende Verschleissfestigkeitsmessungen in vivo. Schweiz Monatsschr Zahnheilkd 89:203–212
12. Midda M (1969) A disclosing solution for synthetic filling. Br Dent J 128:519–520
13. Phillips RW (1973) Skinner's science of dental materials, 7th edn. Saunders, London, pp 217–254
14. Pilz ME, Reimann W, Krause DH (1980) Gerichtliche Medizin für Stomatologen. Barth, Leipzig
15. Sohlheim T, Lorentsen M, Sundnes PK, Bang B, Bremnes L (1992) The "Scandinavian Star" ferry disaster 1990 – a challenge to forensic odontology. Int J Legal Med 104:339–345
16. Sopher IM (1986) Forensische Zahnmedizin. Quintessenz, Berlin
17. Stimpson PG (1985) cited in Clark DH, Ruddick RF (1985) Post mortem detection of tooth coloured dental restorations by ultra violet radiation. Acta Med Leg Soc (Liege) 35:278–284
18. Whittaker D, McDonald G (1989) A colour atlas of forensic dentistry. Wolfe, London, chap. 5 Fig. 60