Short Communication

Pink Teeth in Toxicology

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ABSTRACT

Pink teeth may be seen after trauma, a fight or car accident, and barbiturate poisoning. Pink dentine is visible by external inspection, although a case could be made for any pigmentation present originally in the layers of the tooth root having been leached out over the course of time. In the cases reported in the forensic literature two strong factors seem to contribute to the appearance of the pink colouration. This paper reviews the causes, detection and factors responsible for pink teeth.

Key Words: Pink Teeth, Barbiturates, Trauma, Asphyxia, Haemoglobin, Toxicology

Introduction

Descriptions of 'pink teeth' appearing in forensic literature have several points in common among them. The phenomenon of 'pink teeth' was first described by Thomas Bell as the osseous part of the tooth being coloured red, whilst the enamel was unaffected.[1] Gustafson found that a change in tooth colour is a constant postmortem finding.[2] Furuhata and Yamamato reviewed reports on the occurrence of pink teeth by other Japanese workers, including a report by Kato in 1941.[3] However, only observations of colour changes and pulp congestion and haemorrhage are mentioned. Professor Keith Simpson stated that postmortem pink teeth are probably more common in young rather than old subjects, and in cases of death resulting from a variety of causes, postmortem decomposition being the only common feature.[4] This paper reviews the role of pink teeth in forensic science and toxicology.

Location of Pink Colour in Teeth

Beely and Harvey, Whittaker et al, and Miles & Fearnhead describe a red pink colouration of roots of the teeth, getting particularly deep towards the cemento-enamel junction, fading off, but still visible beneath the enamel.[1,4,5] The pulps in fractured and sectioned teeth were described as being filled with a deep red, or pink, gelatinous material, which extended into the dentine, diminishing in intensity towards the enamel. Miles & Fearnhead and Vanwyk commented upon the variability between even adjacent teeth within the same jaw, some displaying a marked 'pinkness', while others being relatively unaffected.[5-7] Camps reporting on the forensic evidence from the Christie case, explains that one of the victims, Beryl Evans had been interred after autopsy in 1949.[8] The pathologist in the case, Dr. R. D. Teare had not noted the presence of pink teeth. After Christie's confession in 1953, the body of Beryl Evans was exhumed for further postmortem examination, and it was at this time that it was noticed that the roots of the teeth were pink.

Beeley and Harvey describe five cases where pink teeth have been apparent.[1] Two were men aged 30 and 21 whose bodies were recovered from the sea approximately 35 days and 90 days after death respectively. The third was a 40 year old man who had been shot and buried under stones in a wet culvert for 94 days before

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being discovered. A fourth man of 25 years of age had crashed a motor vehicle into a river, the body being recovered 30 days later. The fifth was a 31 year old woman who had taken a barbiturate overdose and was found 46 days postmortem with vomitus in her throat.

Cause and Detection

Whittaker et al used a group of anaesthetised golden hamsters, one half of the group being strangled, the other half given a barbiturate overdose.[4] One half of each group was then placed in soil and the other half in sea water. The onset of pink pigmentation was observed between two and three months later, whach occurred faster and more intensely in the strangled animals. Animals left in brine developed pink teeth faster than those buried in soil. Kirkham et al poisoned an anaesthetised female dog with carbon monoxide. The mandible was resected and divided into two, one half was left in a bag with 15 gm of soil and water, while the other half was placed under a cloth in a fume cupboard.[9] After 14 days, the half of the mandible in soil and water displayed pink teeth, while the half in the fume cupboard did not. Gas chromatography of a blood sample immediately postmortem, showed 81% saturation of carbon monoxide, while fluid from the teeth of the pink specimens showed 41% saturation after 14 days. No details are available for the teeth which are reported as not being pink.

Haemoglobin and its derivatives have been detected in pink teeth by isoelectric focusing.[1,9-10] The presence of increased amounts of iron in pink dentine over normal dentine, presumably from haemoglobin and its decay products, has been confirmed by Ikeda et al using semi-quantitative EDAX analysis.[11] The presence of haemoglobin in dentine have occurred due to sudden rise in blood pressure during a highly traumatic action, such as being strangled or choking to death on vomitus, which can lead to rupture of the arterial system in the tooth and result in presence of erythrocytes in the pulp. Sudden death can also lead to the failure of coagulation mechanisms such that blood retains its fluid properties postmortem.[12] The time delay observed between death and red blood products getting into the dentine may be explained by the fact that erythrocytes average 7.5 mm in diameter, whilst dentinal tubules are only 3mm in diameter, so pink dentine can only occur after the break down of erythrocyte cell walls to allow haemoglobin and break-down products such as porphyrins to filter into the dentine. Takahashi and Williams suggest that the rate for heamolysis is maximum at temperatures less than 10°C which could explain the increase in rate seen in cold conditions such as at sea.[12] In Kirkhan's experiment, the release of free haemoglobin proteins into the blood could be a result of inter-vascular haemolysis caused by carbon monoxide.[9]

Discussion

Carbon monoxide production is generally regarded as a product of physiological catabolism of haemoglobin and other haem compounds. It is formed from the a-methine bridge of the haem ring, and production is enhanced in the presence of barbiturates.[13] The process is also increased after haemolysis, and at acid or alkaline pH.[14] An attempt was therefore made to detect carbon monoxide in pink tooth pulp. The major constituent responsible for pink colouration of postmortem teeth is haemoglobin or a haemoglobin derivative. Indeed, bleeding and congestion of tooth pulp has been associated with death by suffocation and strangulation.[3,15] However, the nature of the pink colouration taken by the haemoglobin within the pulp cavity is less clear. It is a fact that preparation of a sample for spectral analysis has resulted in a loss of pink colour, and it was the absence of a typical carbon monoxide/haemlogbin spectrum which led Camps and his colleagues to conclude that there was "*no reason to believe that the pink colour in teeth is due to carboxyhaemoglobin.*"[8]

There is no single satisfactory explainaction for pink teeth in forensic cases, but it does seem likely that blood products, particularly haemoglobin, may be responsible.

Conclusion

In the cases reported in forensic literature, two strong factors seem to contribute to the appearance of the pink colouration of teeth. Almost all authors report a time delay between death and formation of pink teeth. Where cause of death was known, the reports from forensic literature suggest that individuals with pink teeth have died as a result of great physical trauma. In many cases where there is no direct evidence for a violent death, the cause of death is attributed to asphyxia. The presence of moisture in the environment in which the body was found has also been cited as a contributing factor.

REFERENCES

1. Beeley JA, Harvey W. Pink teeth appearing as a postmortem phenomemon. J Forensic Sci Soc. 1973; 13: 297-305.

2. Gustafson G. Forensic Odontology. 1966. Staples Press, London. 73-75.
3. Furuhata T, Yamamoto K. Forensic Odontology. 1967. Thomas Springfields. 141.
4. Whittaker DK, Thomas VC, Thomas RIM. Postmortem pigmentation of teeth. BDJ. 1976; 140: 100-102.
5. Miles AEW, Fernhead RW. In: Camps FE (ed). Medical and Scientific Investigations in the Christie Case. 1953. Medical Publications Ltd, London. 110-114.
6. Vanwyk CW. Pink teeth after death I: A clinical and histological description. J Odontostomatol 1987; 5: 41-50.
7. Vanwyk CW. Pink teeth after death II: Minor variations. J Odontostomatol. 1988; 6: 35-42.
8. Camps FE. Medical and Scientific Investigations in the Christie Case. 1953. Medical Publications Ltd, London. 33-40.
9. Kirkhan WK, Andrews EE, Snow CC, Grape PM, Snyder L. Postmortem pink teeth. J Forensic Sci. 1977; 119-131.
10. Vanwyk CW. Postmortem pink teeth. Amer J Forensic Med Pathol. 1989; 10: 134-139.
11. Ikeda N, Watanabe G, Harada A, Suzuki TA. Scanning electron microscope and electron probe X-ray analysis of pink teeth. J Forensic Sci. 1988; 33: 119-131.
12. Takahashi T, Williams RJ. Thermal shock hemolysis in human red cells. Cryobiol 1983; 507-520.
13. White P. Carbon monoixide production and heme catabolism. Ann NY Acad Sci. 1970; 174: 23.
14. Sjostrand T. In vitro formation of carbon monoxide in blood. Acta Physiol Scand. 1952; 24: 314.
15. Katsura K, Shinomiya T. Histological finding of dental pulp in strangled dogs. Acta Med. 1958; 12: 127.