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Novel Method for Measuring the Time of Death on Teeth – Based on Liquid Contents, Reflection Spectra and Colour

Presentation of the First Analysis and Measurement Method That Is also Reference-Independent

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Contents

André Hoffmann systematically researched the tooth colour at human teeth and dental shade guides with high-precision measuring systems and high-precision positioning system in vitro with highest precision. Due to this basic scientific research, he was able to quantify and isolate manifold factors influencing the colour of teeth. These include, for example, the light or measuring light and the type of light (illuminant) and illumination and colour temperature, the optical beam path of the light or the measuring geometry, the observation angle (2°, 10°), the size of the measuring surface, and measuring opening, the gloss effect, the liquid content (with scientific evidence of the relationship between liquid content and tooth colour), effect of drying, moisture and rehydration, the correlation between the liquid content and the gloss effect, the subjectivity of visual subjective shade matching, crown curvature, type of system (spectrophotometer, tristimulus colorimeter), measuring mode (contact or non-contact), system-object-relation, positioning, repeatability or reproducibility, lens shift, displacement between sample and measuring surface and further intra- and interindividual factors. In addition, subjective-visual determinations and objectified measurements were examined in subjective-objective comparisons using colour coordinates comparisons. All these influencing factors are investigated on moist, drying, drier (various specific dehydration and rehydration states) and dry teeth based on the brightness (L*), on colour measurement values, such as a*, b* (CIELAB), C*, h, (CIELCH), ΔE, the metamerism index, spectral values and curves, tabs of dental shade guides and tooth colour spaces …

As part of this exploration, phenomena (e.g. changes and breaks in behaviour as well as highly individual developments in colour values, paradoxes between the values of subjective determination using tooth shade patterns and the values of objective measurements) were identified; and insights into the very complex colour dynamics through dehydration and rehydration were shown (up to more than >8 days). The development of the individual colour measurement values was based on the liquid flow through the tooth and its tissues, in particular during drying and rehydration, and gave information about dynamics and the temporal extent of these processes.

On the basis of this data, Hoffmann had developed several methods for research and practice, suggestions for feasible innovations, such as monitoring of dental treatment to protect against pulp damage based on drying, and reconstructing the colour of naturally moist teeth on those that have already dried, the identification of the living and the dead, human and animals via the “dental fingerprint” and a novel method of measuring the time of death for forensic medicine.

He also described a time limit of drying up to which relatively natural, suitable colour values and shade matching results can be obtained and after which no colour determination should be carried out; and he established the rehydration time after the end of the drying or dental treatment, which must be waited in order to regain a natural tooth colour and to get correct values and results again.

His findings also show that teeth are able to store information, for example, on the condition (liquid content, colour values) and about the time within the drying and fluid reabsorption chronology. The author articulates a “dental chronometer” (“tooth clock”), “dental data storage” (“tooth data storage”) and a “dental memory” (“tooth memory”) and believes that significant progress in this area may include and could be achieved via a neural network for colour measurement apparatus.

Preface

As part of my scientific research on dental tissues and electromagnetic radiation and my work as an innovator, process and system developer, I have considered what dental processes can still be used for. I quickly came across the field of estimation of the time of death.

In addition, as a studied dentist, who is accustomed to high precision, I have found that in this field only a relatively imprecise estimate is conceivable due to intra- and inter-individual influences.

Previously known forensic-medical possibilities for estimating the time of death must inevitably be inaccurate. I wondered whether the limitations are insurmountable, or whether there could be a specific process and a technology, which could have a high level of accuracy and a statement after longer times in this forensic field.

The problem that has been inherent in the methods so far lies – in my opinion – in the dispersion of data, which is inherent in methods or tissues: the general scientific prerequisite for the use of a method for estimation the time of death is the existence of a process that is triggered by death and must be descriptive and differentiated in stages (e.g. rigor and livor mortis, putrefaction) or values (see body cooling method). In order to classify these stages or values, the results of previous studies were always needed. The assessment and estimation in the specific application is carried out in the light of previous studies. Without exception, all processes described in the literature in connection with the time of death estimations are highly individual, contain an intra- and inter-individual dispersion of reference values/stages/phenomena, are irreversible, so cannot be reversed, and without exception all methods use reference values (e.g. temperature) or reference descriptions. An assessment of a current time of death against the background of scattered references can be imprecise at best.

Quite different, as you will read in the book, the novel approaches and developed methods. Because not only one process, but above all the measurable processes that a tooth goes through during drying are very special and unique in their character. Read about the advantages and the special character of the usable processes and perhaps even the first reference-independent method of analysis or measurement in the natural sciences.

You will find out what this ultimately means and how you can measure processes with which systems and avoid errors in colorimetrics and spectrophotometry at teeth. Join me on a path that will introduce you to the colour theory, to the high-precision spectral analysis, colorimetry and liquid content measurement, to the topic of estimation of the time of death or, as we might call it in the future, death time measurement, and other novel and innovative technology-based methods.

I would be very pleased if you were as fascinated by the path, just as the way fascinated me when I first walked this path; and I would be pleased if you are grabbed by the subject just as it grabbed me and still captivates me.

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