

Pewarnaan gigi buatan untuk keperluan penelitian

Artificial Dental Stain for Research

Erlina Sih Mahanani

Dentistry Study Program, Faculty of Medicine Muhammadiyah University of Yogyakarta, and Contract Lecturer in School of Dental Sciences, Health Campus, Universiti Sains Malaysia, Kelantan, Malaysia

Abstract

Nowadays, regarding the increased of aesthetic demands, the dental staining is a common problem. It can be caused by exogenous or endogenous source. It may adhere directly to the surface, contain within calculus and soft deposit, or incorporate within the tooth structure. Many studies are conducted to evaluate the ability of material or herbal to remove or inhibit dental staining. Therefore it is needed a method to produce the artificial stain for specimen.

This article has an objective to give information about the artificial dental stain for research. Combination between chlorhexidine and tea has been reported that it can produce fast and optimum artificial stain. Meanwhile it is needed artificial saliva to stimulate pellicle in the specimen surface so the stain source can attach. The clear acrylic block is used as a specimen and spectrophotometer for measuring the optical density of staining and Lobene score index for visual assessment.

Keyword: chlorhexidine, dental stain, method, tea

Abstrak

Pewarnaan gigi adalah masalah yang sering terjadi, bisa disebabkan faktor dari dalam maupun dari luar, dan dapat bersifat sementara di permukaan, bersatu dengan karang gigi ataupun telah masuk dalam struktur gigi. Banyak penelitian dilakukan untuk mengetahui kemampuan suatu bahan untuk mengurangi atau mencegah terjadinya pewarnaan gigi. Oleh sebab itu diperlukan suatu metoda penelitian untuk menghasilkan pewarnaan buatan pada spesimen.

Tujuan penulisan artikel ini adalah untuk memberikan suatu gambaran metoda pewarnaan gigi buatan untuk keperluan penelitian. Kombinasi antara teh dan obat kumur *chlorhexidine* telah banyak diteliti dapat menghasilkan pewarnaan yang cepat dan optimal. Selain itu diperlukan saliva buatan untuk menghasilkan *pellicle* di permukaan spesimen sehingga sumber pewarna bisa menempel. Digunakan akrilik jernih sebagai spesimen dan spektrofotometer untuk mengukur *optical density* pewarnaan gigi dan Lobene skor indek untuk penilaian visual.

Kata kunci: *chlorhexidine*, metoda, pewarnaan gigi, teh

Introduction

Stain is a discoloured spot or area on a tooth that contrasts with the rest of the tooth colour. Discolorations of the teeth occur in 3 general ways : (1) stain adheres directly to the surfaces, (2) stain contained within calculus and soft deposit and (3) stain

incorporated within the tooth structure or the restorative material.

Classification of stains can be divided based on the location or source. Classification by location is: (1) extrinsic stains occur on the external surface of the tooth and may be removed by procedures

of tooth brushing, scaling and/or polishing and (2) intrinsic stains occur within the tooth substance and cannot be removed by techniques of scaling or polishing.

Classification by source is: (1) Exogenous stains develop or originate from sources outside the tooth. Exogenous stains may be extrinsic and stay on the outer surface of the tooth or intrinsic and become incorporated within the tooth structure and (2) Endogenous stains develop or originate from within the tooth. Endogenous stains are always intrinsic and usually are discolorations of the dentin reflected through the enamel.¹

Dental staining can occur on the external surface of the tooth (extrinsic) or within the tooth substance (intrinsic). There is different opinion regarding the mechanism of dental stain. According to the study, there is limited understanding on the etiology and mechanism of tooth discoloration.^{2,3} Meanwhile in the research we need the artificial dental stain to investigate the ability of some materials to remove or inhibit the stain. There are many studies have been done to produce the artificial staining in tooth or in specimen like acrylic material. From this reason this article has objective to give information about the artificial stain for research.

Discussion

The dietary theory of extrinsic tooth staining associated with such agents was compounded years ago and later supported by a considerable number of laboratory and clinical studies.³ Dietary factors play an aetiological role in staining and have been used in vitro to study and compare the activity of rinses. Consumption of food and drinks such as coffee, tea, red wine and berries, curry and colas result in surface staining and absorptive staining. Tannin stains from tea and coffee are more tenacious.⁴ Tannins are composed of *polyphenols* such as *catechins* and *leucoanthocyanins* and it is the gallic acid derivatives in the *polyphenols* that causes the yellow-brown stain. The tannins may also act as stain promoters.⁵

Chlorhexidine is one of chemical antiplaque agent that has a broad spectrum of bactericidal activity against gram-negative and gram-positive organisms. The positively charged *chlorhexidine* bind to bacterial cell walls and to various oral surfaces including the *hydroxyapatite* of tooth enamel. The organic pellicle covers the tooth surface, mucous membrane, and salivary protein. Besides acting immediately on oral bacterial, it is retained on the tooth surface to exert a prolonged bactericidal effect, and subsequently as the concentration falls, a bacteriostatic effect for several hours. It interacts with bacteria, damaging permeability barriers and precipitating cytoplasm.⁶

Mouthwash containing *chlorhexidine* causes superficial black and brown staining of the teeth.^{7,8,9,10} The staining is enhanced in the presence of tea and coffee. It may be related to the precipitation of chromogenic dietary factors on to the teeth and mucous membranes.⁸ Clinical and in vitro studies have implicated dietary components as major aetiological factors in staining of teeth and acrylic materials associated with *chlorhexidine* use, a local side effect not unique to this antiseptic.⁷ The interaction of *chlorhexidine* with dietary chromogens to cause extrinsic dental staining has been exploited in vitro and in vivo to study tooth discoloration and its control.¹¹ Previous randomised controlled clinical trials have indicated that tea and coffee contribute to dental and tongue staining associated with *chlorhexidine* mouth rinses.⁹

It is probable that the associated cationic group attaches *chlorhexidine* to the tooth, while the other cationic group producing the bacteriocidal effect can attach the dietary factors, such as gallic acid derivatives (polyphenols) found in foods and beverages such as tea and coffee and tannins, from wine to the molecule and hence to the tooth surface.^{9,10} It was found that *chlorhexidine* absorbed to the pellicle and caused a modification of the pellicle properties, leading to subsequent increase in adsorption of salivary and black tea

components. This increase in adsorption resulted in a concomitant increase in the stain.¹²

The interaction between *chlorhexidine* and tea is particularly known to promote staining. This in fact, can be exploited for in vitro studies to force stain production in subjects over a period of few days.^{7,8} Thus, the efficacy of object which we want to investigate at inhibiting or reducing the formation of staining can be assessed over a few days instead of over a few weeks or months. Arising from this research, it became apparent that the laboratory and clinical models could be manipulated to study a range of variables, including those influencing the rate of stain formation, the activity of agents in formulations, the potential of new actives to cause staining and stain inhibition and removal by products and formulations.¹³

The standard protocol has been done in some studies to manipulate the staining. The staining was produced by cycling specimens through artificial saliva for 2 minutes, then 0.2% *chlorhexidine* mouth rinse for 2 minutes and the last warm tea solution (50°) for 30 minutes. The whole staining process was repeated for 8 times a day. The specimens were rinsed with distilled water after each component of cycle was done.^{11,14,15} The *chlorhexidine* and tea staining was standardized as much as possible. A brand of *chlorhexidine* was used; the same brand of tea and infusion method was consistent.¹⁴ The tea solution was produced by mixing 5 teabags of tea in 1litre of water at 50°C temperature. Tea temperature was significantly influenced staining and the maximum staining effect of tea was at 50°C. *Chlorhexidine* temperature did not influence staining. The duration of *chlorhexidine* and tea exposures increased the staining, proportionately to a small degree. Early studies in vivo indicated that the uptake was rapid during first 30s and then slowed down, to plateau by 60s. Thus, exposing specimens for 2 and 4 minutes to *chlorhexidine* would therefore be unlikely to increase the amount of *chlorhexidine* on the surface to react with tea.¹¹

The saliva we shall use the artificial saliva.¹⁵ There was study use the saliva from same individual was employed. This is considered necessary due to significant effect of using different sources of saliva,¹⁶ but it was difficult.

The specimen for staining was used clear acrylic block. Size of specimen was considered by Spectrophotometer chamber. Clear acrylic block was used because it can be measured by Spectrophotometer and the surface can be polish smoothly so the pellicle will attach in its.^{14,15}

Spectrophotometer reading was highly sensitive since it can measure the staining. It measures the optical density of clear acrylic at lambda maximum of 700 nm. The baseline of optical density reading range can be determined by researcher considered with the objective of study. For cross check the staining of specimens were also graded visually using the intensity score of the Lobene (1968) stain index by giving score 0=no stain, 1=light stain, 2=moderate stain, 3=heavy stain.^{14,15,17}

Conclusion

The standard protocol for staining can be used to get the dental artificial staining; it use combination of tea and *chlorhexidine* as a stain source and artificial saliva to stimulate the pellicle in specimen surface. The stain can be measured by spectrophotometer and Lobene Stain Index for visual assessment cross check. The artificial staining may useful to investigate the ability of an object or a material for reducing or inhibiting the stain.

References

1. Wilkin E.M, (1999) Dental stain and discoloration. *Clinical Practice of the Dental Hygienist*. 8th Edition. Lippincott Williams & Wilkins, 285-286
2. Addy, M. & Moran, J. (1995) Mechanism of stain formation on teeth, in particular associated with metal ions and antiseptics. *Advances in Dental Research* 9, 450-456
3. Watts, A. & Addy, M, (2001). Tooth discoloration and staining; a review of

- the literature. *British Dental Journal* 190, 309-316
4. Greenwall L (editor), Freedman GA, Gordan VV, Haywood VB, Kelleher, M, Mclaughin G, and Rotstein I (2001) *Whitening Toothpaste: Bleaching Techniques In restorative Dentistry*. 1st Edition. Martin Dunitz Ltd, 42-44
 5. Eriksen HM, Nordbo H (1978) Extrinsic discoloration of teeth. *J Clin Periodontol* 5: 229-36.
 6. Murray JJ, Nunn J.H, and Steele J.G, (2003). Chemical that can help to reduce plaque formation. *The Prevention of Oral Disease*. 4th Edition. Oxford University Press, 136-138
 7. Addy M, and Moran J (1984) The formation of stain on acrylic surfaces by the interaction of cationic antiseptic mouthwashes and tea. *J Bioned Mater Res* 18(6):631-41.
 8. Addy M, Moran J, Griffiths A, and Wills-Wood N J (1985). Extrinsic tooth discolouration by metals and chlorhexidine. I: Surface protein denturation or diet precipitation? *Br Dent J*, 159:331-334.
 9. Leard A and Addy M (1997). The propensity of different brands of tea and coffee to cause staining associated with chlorhexidine. *J Clin Periodontol*, 24(2):115-8.
 10. Eley BM (1999). Antibacterial agents in the control of supragingival plaque- a review. *Br Dent J*, 186: 286-96
 11. Pontefract H, Courtney M, Smith S, Newcombe RG and Addy M (2004). Development of methods to enhance extrinsic tooth discoloration for comparison of toothpastes. 1. Studies in vitro. *J Clin Periodontol*, 31(1):1-6.
 12. Joiner A (2006). Review of the extrinsic stain removal and enamel/dentine abrasion by a calcium carbonate and perlite containing whitening toothpaste. *Int Dent J*, 56(4):175-80.
 13. Sharif N, MacDonald E, Hughes J, Newcombe RG, and Addy M (2000). The chemical stain removal properties of 'whitening' toothpaste products: studies in vitro. *British Dental Journal*, 188(11):620-24.
 14. Manab EEA, and Arief EM. (2006). The Effectiveness of two whitening toothpastes at removing tea and chlorhexidine stain: in vitro study. Elective Report Project of DDS, School of Dental Sciences, USM
 15. Samuel SV, ES Mahanani, and EM Arief (2007) The Effectiveness of *Salvadora persica* at removing tea and chlorhexidine stain. Elective Report Project of DDS, School of Dental Sciences, USM
 16. Sheen S, Banfield N, and Addy, M. (2001). The propensity of individual saliva to cause extrinsic staining in vitro- a developmental method. *Journal of Dentistry* 29, 99-102
 17. Lobene, R. A (1968). Effect of dentifrices on tooth stain with controlled brushing. *Journal of the American Dental Association* 77.849-855
-