

POST-BLEACHING SENSITIVITY IN PATIENTS WITH SICKLE CELL DISEASE

Guacyra M. Lisboa¹, Verônica L. Guedes², Maria do R. M. L. Luna³, Américo M. Carneiro-Jr⁴, Roberto C. Stegun⁵

¹ Department of Dentistry, Hemocentro de Alagoas, Brazil.

² Department of Hematology, Hemocentro de Alagoas, Brazil.

³ Department of Dentistry, Laboratório Central de Saúde Pública de Alagoas, Brazil.

⁴ Department of Dentistry, Instituto de Atendimento e Estudos Odontológicos do Nordeste, Alagoas, Brazil.

⁵ Department of Dental Prosthesis, School of Dentistry, University of São Paulo, Brazil.

ABSTRACT

Sickle cell disease (SCD) is a monogenic disease that affects millions of people worldwide. This study analyzed the effectiveness of bleaching and tooth sensitivity after in-office bleaching in patients with SCD. Forty volunteers were randomly assigned to four groups of 10 patients each (five with the SCD and five healthy controls) and treated using in-office bleaching with 35% hydrogen peroxide and different light activation protocols. No statistically significant difference was

observed with relation to presence of tooth sensitivity, with or without use of a source of light for peroxide activation, and all bleaching therapies were effective, regardless of the technique employed and the presence/absence of sickle cell disease. The data showed that in-office dental bleaching is a viable alternative for improvement of oral esthetics for patients with SCD.

Key words: Esthetics, hydrogen peroxide, tooth bleaching.

SENSIBILIDADE DENTÁRIA PÓS-CLAREAMENTO EM PACIENTES COM DOENÇA FALCIFORME

RESUMO

A doença falciforme (DF) é a doença monogênica e afeta milhões de pessoas em todo o mundo. Este estudo analisou a eficácia do clareamento e a presença de sensibilidade dentinária após clareamento dental em portadores de DF. Quarenta voluntários distribuídos aleatoriamente em quatro grupos com diferentes fontes de luz foram submetidos à técnica de clareamento em consultório, utilizando peróxido de hidrogênio a 35%. Não foram encontradas diferenças estatisticamente significativas em relação à presença de sensibilidade,

com ou sem a utilização de uma fonte de luz para acelerar a ativação do peróxido e todos os clareamentos foram efetivos, independentemente da técnica utilizada e da presença/ausência de DF. Os dados mostraram que o clareamento dental em consultório, utilizando peróxido de hidrogênio a 35% é uma alternativa viável para melhoria da estética em pacientes com DF.

Palavras-chave: Clareamento dental, Estética, Peróxido de hidrogênio.

INTRODUCTION

Sickle cell disease (SCD) is the most common monogenic disease in the world¹, affecting millions of people. In Brazil, 20,000 to 30,000 people are estimated to have sickle cell disease, which tends to increase as a result of the high degree of miscegenation^{2,3}.

The disease is caused by the replacement of glutamic acid with valine in the sixth position of the β -globin chain, resulting in abnormal cells referred to as hemoglobins S (HbS, as in sickle). When oxygen is absent or low, HbS molecules are polymerized and

lose their normal round morphology, shortening the mean life of red blood cells, causing vessel occlusion and infarction, and consequently leading to ischemia, pain, necrosis, dysfunction, permanent damage to tissues and organs, and chronic hemolysis^{4,5}.

In 1973, life expectancy of patients with sickle cell disease was 14 years; at present, in patients under strict medical monitoring, life expectancy can reach approximately 70 years⁶.

As a result of the peculiarities of sickle cell disease, these patients require special attention during treatment and clinical management, requiring pre-

established protocols for procedures considered routine in dental practice⁷.

Tooth bleaching is a conservative method for dental structures and is therefore widely sought for the improvement of oral esthetics. Tooth sensitivity after bleaching is the side-effect most frequently reported by patients who have undergone bleaching⁸.

This study analyzed the effectiveness of bleaching, and tooth sensitivity after in-office bleaching, in patients with SCD. It was motivated by the growing interest in dental bleaching among patients with sickle cell disease and the scarcity of studies on bleaching efficacy and the behavior in this specific population regarding the procedure.

MATERIALS AND METHODS

Ethical considerations

This study was approved by the Research Ethics Committee of Universidade Estadual de Ciências da Saúde de Alagoas (protocol no. 949/08) and written informed consent was obtained from all study participants.

Selection of subjects

This study enrolled forty volunteers aged 18 to 45 years, of both genders, with no caries, with vital teeth in the gap between first premolars of the maxilla and mandible and good periodontal health, who agreed to participate in the study and signed informed consent.

Exclusion criteria were patients who had used any bleaching agents within the past year, had deficient restorations, reported any tooth sensitivity, spontaneous or triggered by air spray, had taken any kind of analgesic or anti-inflammatory drugs within one month before bleaching, smokers and pregnant or lactating women.

Volunteers were randomly assigned to four groups of 10 patients each: five with sickle cell disease and five healthy controls.

Data collection

All participants underwent in-office bleaching with 35% hydrogen peroxide (Whiteness HP Maxx, FGM Dental Products, Joinville, Brazil). The bleaching agent was applied three times, each session lasting 15 minutes. Before the bleaching procedures, they received prophylaxis with pumice and water in a rubber cup.

Group 1 was treated with a halogen light unit (photopolymerizer CL-K220, Kondortech, São Carlos, Brazil), and the bleaching agent was activated on each individual tooth for 30 seconds per tooth. In Group 2, a light emitting diode (LED) unit was used (Easy Bleach, Clean Line, Taubaté, Brazil), and activation also took place on each individual tooth, for 30 seconds per tooth. In Group 3, a LED/laser unit was used (Easy Bleach, Clean Line, Taubaté, Brazil), and peroxide was activated simultaneously on both arches, for 3 minutes. In Group 4, no light source was used to activate the bleaching agent.

Bleaching treatment efficacy was assessed using the Vitapan Classical shade guide (Vita-Zahnfabrik, Bad Säckingen, Germany). In this guide the colors are organized from B1 (lighter) to C4 (darker) and numbered from 1 (B1) to 16 (C4)⁹. The area for color matching was the middle third of the buccal surface of the central upper left incisor and it was evaluated by a duly calibrated examiner. Color was determined before and after bleaching.

Absence of tooth sensitivity was evaluated at the following times: during the first 5 hours, at 6-12 hours, 13-24 hours, 25-72 hours (2-3 days), 73-192 hours (4-8 days), and 193-240 hours (8-10 days). Each patient was also asked to describe whether tooth sensitivity was spontaneous or provoked. If provoked, patients were asked to report the factor that triggered sensitivity: heat, cold, speaking or other.

Statistical analysis

Statistical analysis was performed using the BioEstat software, version 5.0 (Optical Digital Technology, Belém, Brazil). Tooth sensitivity data were analyzed by Fisher's exact test and effectiveness of bleaching data was analyzed by paired t test. Significance level was set at 5% ($p < 0.05$).

RESULTS

All bleaching therapies were effective, regardless of the technique employed and the presence/absence of sickle cell disease (Table 1, Fig. 1). Provoked and/or spontaneous sensitivity were experienced by 72.5% (29 out of 40) of the volunteers. However, it was absent in the following periods: 73-192 hours (4-8 days) and 193-240 hours (8-10 days).

Table 1: Analytical results for color determined before and after in-office dental bleaching with 35% hydrogen peroxide.

Technique	Halogen unit		LED		LED/laser		No light	
	SCD	No SCD	SCD	No SCD	SCD	No SCD	SCD	No SCD
Volunteers								
Mean Differences	3.0000	3.2000	3.2000	2.6000	3.8000	3.6000	3.4000	2.6000
Standard Deviation (SD)	1.2247	1.3038	1.3038	1.1402	1.3038	0.5477	1.6733	0.8944
t- value	5.4772	5.4880	5.4880	5.0990	6.5169	14.6969	4.5354	6.5000
P- value (2-tailed)	0.0054*	0.0054*	0.0054*	0.0070*	0.0029*	0.0001*	0.0105*	0.0029*

*Significance (P < 0.05)

Table 2: How sensitivity developed in 40 volunteers (20 with and 20 without sickle cell disease) after in-office dental bleaching, according to technique employed.

	Halogen		LED		LED/laser		No light	
	SCD	No SCD	SCD	No SCD	SCD	No SCD	SCD	No SCD
SENSITIVITY								
Heat	-	-	-	-	-	-	-	-
Cold	-	-	-	1	-	1	2	-
Speaking	-	3	-	1	-	-	-	-
Heat + Cold	-	-	-	-	-	-	-	-
Heat + Speaking	1	1	-	-	-	-	-	-
Cold + Speaking	-	-	3	-	-	-	-	-
Heat + Cold +Speaking	1	1	2	1	3	2	-	1
Spontaneous	1	-	-	-	1	-	2	1
No sensitivity	2	-	-	2	1	2	1	3

- no occurrence

The way in which sensitivity developed varied among volunteers. Five volunteers reported only spontaneous sensitivity; twenty-four reported provoked sensitivity, of whom seventeen also reported spontaneous sensitivity.

The factor that triggered sensitivity also differed among volunteers, with the factor most often mentioned being SPEAKING, which was cited by 50% of volunteers (Table 2).

Only two participants mentioned others factors, both associated with SPEAKING that triggered tooth sensitivity: when brushing teeth and when smiling.

Whether or not a light source was used to activate

hydrogen peroxide did not produce statistically significant differences in terms of tooth sensitivity, regardless of the presence or absence of sickle cell disease (Table 3).



Fig. 1: Tooth color before and after in-office bleaching with 35% hydrogen peroxide, (A) volunteer with SCD (B) volunteer without SCD.

Table 3: P values obtained for presence of sensitivity in 40 volunteers (20 with and 20 without sickle cell disease) after in-office dental bleaching according to technique employed.

Technique compared	Sickle cell disease	No sickle cell disease	Significance
	P	P	
Halogen vs. LED	0.4444	0.4444	NS
Halogen vs. LED/laser	1.0000	0.4444	NS
Halogen vs. no light	1.0000	0.1667	NS
LED vs. LED/laser	1.0000	1.0000	NS
LED vs. no light	1.0000	1.0000	NS
LED/laser vs. no light	1.0000	1.0000	NS

P = critical value, NS = not significant.

DISCUSSION

Pain is the most frequent symptom in patients with sickle cell disease. The frequency and severity of painful episodes vary among patients. Some patients feel pain on a daily basis; others only occasionally^{10,11}. Dehydration, infection, stress and cold temperatures are some of the factors that may trigger painful episodes¹². Painful crisis duration may range from some hours to weeks¹⁰.

An esthetically pleasing appearance contributes to increasing self-esteem and wellbeing. In this scenario, tooth bleaching has become a popular treatment, because it preserves tooth structure and improves appearance without any major adverse effects¹³.

Approximately 67.5% of patients with sickle cell disease exhibit intrinsic opacity related to organic matrix hypocalcification during the mineralization phase^{14,15}. Because of the increased levels of opacity observed in these patients, Okafor et al.¹⁵ suggested that they should undergo treatment by bleaching or capping of the teeth, depending on the severity of the problem or esthetic compromise.

Almeida et al.¹⁶ and Mondelli et al.¹⁷ evaluated 40 and 48 patients respectively. Both demonstrated that all bleaching techniques tested were equally effective with or without light. They concluded that light sources were unnecessary to bleach teeth. These results are compatible with the findings of our study, where bleaching was effective in all groups, regardless of whether or not a light source was used to activate the hydrogen peroxide.

For sensitivity triggers, the data show that HEAT alone did not trigger sensitivity, being mentioned only when associated with SPEAKING, which in this case might have been a confounding factor.

Presence of sensitivity and whether or not a light source was used to accelerate the hydrogen peroxide treatment showed no statistically signi-

ficant difference in patients with or without sickle cell disease. Almeida et al.¹⁸ and Bernardon et al.¹⁹ found similar results in their studies. However, these findings differ from those reported by Kossatz et al.²⁰, who observed more persistent and higher sensitivity levels 24 hours after treatment in the group treated with light activation. Similarly, He et al.²¹ observed that the light-activated system produced a higher percentage of tooth sensitivity than the non-light-activated system during in-office bleaching.

Tooth sensitivity was reported by 72.5% of the patients and lasted 3 days or less. Tang and Millar²², also reported that 85.2% of the patients experienced tooth sensitivity at some point following the bleaching procedures.

Despite the fact that in-office bleaching is a lengthy procedure, where the patient spends about an hour motionless, in a situation that can easily cause stress, none of the volunteers with SCD reported a painful crisis after the procedure, suggesting that there is no need for specific protocols to perform in-office dental bleaching with 35% hydrogen peroxide in these patients. However, due to the peculiarities of SCD, the most appropriate time to perform the procedure should be selected in conjunction with the medical staff in charge of the patient.

No statistically significant difference was observed in relation to presence of tooth sensitivity among patients with and without sickle cell disease, regardless of whether or not a source of light was used for peroxide activation. On the other hand, our data showed a significant statistical difference for bleaching effectiveness, proving that the purpose of the procedure was achieved. Teeth were bleached in both groups assessed, showing that in-office dental bleaching is a viable alternative for improvement of oral esthetics for patients with SCD.

ACKNOWLEDGEMENTS

The authors are grateful to FGM Dental Products, which donated the bleaching kits used in the study. We thank Sidney Santos and Elifabiana Araújo for assistance with recruitment of study participants, and Taynah and Gyulia Rabelo for all the help provided during the study.

REFERENCES

1. Adjei GO, Goka BQ, Enweronu-Laryea CC, Rodrigues OP, Renner L, Sulley AM, Alifrangis M, Khalil I, et al. A randomized trial of artesunate-amodiaquine versus artemether-lumefantrine in Ghanaian paediatric sickle cell and non-sickle cell disease patients with acute uncomplicated malaria. *Malar J* 2014;13:369.
2. Simões BP, Pieroni F, Barros GMN, Machado CL, Cançado RD, Salvino MA, Ângulo I, Voltarri JC. Brazilian Consensus Meeting on Stem Cell Transplantation: Hemoglobinopathies Committee. *Rev. Bras. Hematol. Hemoter* 2010; 32: 46-53. <http://dx.doi.org/10.1590/S1516-84842010005000020>.
3. Rodrigues DOW, Ferreira MCB, Campos SEM, Pereira PM, Oliveira CM, Teixeira TB. History of newborn screening of sickle cell disease in Brazil – the Minas Gerais.state chapter. *Rev Med Minas Gerais*. 2012;22:66-72.
4. Shenoy S. Hematopoietic Stem Cell Transplantation for Sickle Cell Disease: Current Practice and Emerging Trends. *Hematology Am Soc Hematol Educ Program* 2011;10: 273-279.
5. Hsieh MW, Fitzhugh CD, Tisdale JF. Allogeneic hematopoietic stem cell transplantation for sickle cell disease:the time is now. *Blood* 2011; 118:1197-1207.
6. Jenerette CM, Brewer C, Leak AN. Self-Care Recommendations of Middle-Aged and Older Adults with Sickle Cell Disease. *Nurs Res Pract* 2011;2011:270594.
7. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Especializada. Manual de saúde bucal na doença falciforme. Brasília: Ministério da Saúde; 2005 URL: http://bvsmms.saude.gov.br/bvs/publicacoes/manual_saude_bucal_doenca_falciforme.pdf
8. Lam H P, Wilson N. Effects of different desensitizing agents on bleaching treatments. *Eur J Gen Dent*. 2014;3:93-99.
9. Wang W, Zhu Y, Li J, Liao S, Al H. Efficacy of cold light bleaching using different bleaching times and their effects on human enamel. *Dent Mater J* 2013;32:761-766.
10. Shapiro BS, Benjamin LJ, Payne R, Heidrich G. Sickle cell-related pain:Perceptions of medical practitioners. *J Pain Symptom Manage* 1997;14:168-174.
11. Adegbola M. Genomics and Pain Research in Sickle Cell Disease: An explanation of heterogeneity? *ISRN Nurs*. 2011;2011:672579. DOI: 10.5402/2011/672579.
12. Serjeant KP, Mason IR, Hambleton CF, Higgs DR. The changing face of homozygous sickle cell disease: 102 patients over 60 years. *Int J Lab Hematol* 2009;31:585-596.
13. S PM, M AB, Tejaswi S, Shetty S, K SH. Effect of Power Bleaching on the Fluorosis Stained Anterior Teeth Case Series. *J Clin Diagn Res* 2014: 1-3. DOI: 10.7860/JCDR/2014/9657.
14. Luna AC, Rodrigues MJ, Menezes VA, Marques KM, Santos FA. Caries prevalence and socioeconomic factors in children with sickle cell anemia. *Braz Oral Res* 2012:43-49.
15. Okafor LA, Nonnoo DC, Ojehanon PI, Aikhionbare O. Oral and dental complications of sickle cell disease in Nigerians. *Angiology* 1986; 37:672-675.
16. Almeida LC, Riehl H, Santos PH, Sundfeld ML, Briso AL. Clinical evaluation of the effectiveness of different bleaching therapies in vital teeth. *Int J Periodontics Restorative Dent* 2012; 32:303-309.
17. Mondelli RF, Azevedo JF, Francisoni AC, Almeida CM, Ishikiriyama SK. Comparative clinical study of the effectiveness of different dental bleaching methods - two year follow-up. *J Appl Oral Sci* 2012;20:435-443
18. Almeida LC, Costa CA, Riehl H, dos Santos PH, Sundfeld RH, Briso AL. Occurrence of sensitivity during at-home and in-office tooth bleaching therapies with or without use of light sources. *Acta Odontol Latinoam* 2012;25:3-8.
19. Bernardon JK, Sartori N, Ballarin A, Perdigão J, Lopes GC, Baratieri LN. Clinical performance of vital bleaching techniques. *Oper Dent* 2010;35:3-10.
20. Kossatz S, Dalanhol AP, Cunha T, Loguercio A, Reis A. Effect of light activation on tooth sensitivity after in-office bleaching. *Oper Dent* 2011;36:251-257.
21. He LB, Shao MY, Tan K, Xu X, Li JY. The effects of light on bleaching and tooth sensitivity during in-office vital bleaching: a systematic review and meta-analysis. *J Dent* 2012;40:644-653.
22. Tang B, Millar BJ. Effect of chewing gum on tooth sensitivity following whitening. *Br Dent J* 2010;208:571-577.

CORRESPONDENCE

Dr. Guacyra Machado Lisboa
Rua Desembargador Tenório, 225/1503 - Farol
57050-050 – Maceió, AL, Brazil
gmlgat@uol.com.br