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# The Efficacy of “Walking” Bleach Technique in Endodontically Treated Teeth – Case Report

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## SUMMARY

**Introduction** Discolored teeth in the anterior region can cause considerable cosmetic impairment. One of the techniques commonly used for bleaching endodontically treated teeth is “walking” bleach technique, which in many cases provides satisfying results. The aim of this study was to evaluate bleaching efficacy of “walking” bleach technique in an endodontically treated tooth.

**Case Report** A 22-year-old patient showed up to the clinic because of discoloration of the maxillary right central incisor. The mixture of sodium perborate and 30% hydrogen peroxide was applied and changed weekly. The total duration of therapy was 28 days. At the end of therapy, the tooth achieved 3 shades lighter color.

**Conclusion** The mixture of sodium perborate and 30% hydrogen peroxide can successfully bleach discolored endodontically treated teeth.

**Keywords:** teeth whitening; non-vital teeth; “walking” bleach technique

## INTRODUCTION

Bleaching of discolored endodontically treated teeth is very important procedure in endodontics as well as in aesthetic dentistry. Individually discolored teeth, especially in the anterior region represent a great aesthetic problem. An outpatient method of bleaching considers teeth whitening using high concentrations of hydrogen peroxide or carbamide peroxide.

In 1961, Spasser recommended the application of sodium perborate and water in the pulp chamber as possible way to bleach discolored non vital teeth [1]. Nutting and Poe in 1963 modified this technique by replacing water with 30% hydrogen peroxide and new technique was called “walking” bleach technique [2]. Bleaching agent was the mixture of sodium perborate and water in a 2:1 ratio (g/ml) giving the alkaline pH. Sodium perborate is white crystalline powder that exists in several forms as monohydrate, trihydrate and tetrahydrate (depending on the amount of crystallized water).

The reason for discoloration of endodontically treated teeth can be disseminated blood products in the pulp chamber and dentinal tubules due to trauma as well as the consequence of pulp extirpation or obturation material applied during endodontic treatment. During the degradation of blood products (hemin, hemosiderin, hematoidin, hematoporphirin...) iron ions are released, and react with hydrogen sulphite giving iron sulfide which is black in color. It can cause crown discoloration [3]. Protein degradation of the necrotic pulp is also very important factor that can lead to crown discoloration. Amino-acid compounds released from proteolytic processes are the

source for further decay and invasion of new bacteria [4]. Other factors that can lead to tooth discoloration are obturation materials such as AH 26, endometasone, iodoform cement as well as medicaments which contain tetracycline and iodine [5]. Frequently, discoloration occurs as the consequence of metal ions release from silver points and amalgam [6].

The aim of this study was to evaluate bleaching efficacy of “walking” bleach technique in an endodontically treated tooth.

## CASE REPORT

A 22-year-old woman showed up to the dentist because of cosmetic dental problem caused by discoloration of endodontically treated upper right central incisor. The color of the tooth was darker as compared to other teeth in the upper jaw (Figure 1). White spots were observed on other teeth also, making aesthetic problem even greater. The patient confirmed the presence of white spots on the anterior teeth from childhood. Dental history revealed endodontic treatment of the upper right central incisor three years ago. There was no information about the possible trauma of the tooth, clinical and radiographical analysis showed adequate obturation of the root canal and no need for retreatment.

After informing the patient about the risks, possibilities and limits of all methods available for aesthetic treatment of the discolored tooth, intracoronal bleach technique using mixture of sodium perborate and 30% hydrogen peroxide was chosen as therapy. After removing dental

plaque and old composite filling on the palatal surface, the cavity was prepared. The remnants of endodontic sealer were noticed on the cavity walls. After thorough removal (cleaning) the paste from the pulp chamber walls, obturation material was removed 2 mm apically of the cement-enamel border and GIC (Alfagal, Galenika) 1 mm thick was applied (Figure 2).

After determining color using Vita key (Vita Zahnfabrik, Germany), the color A4 was registered and preliminary images were taken. Sodium perborate (trihydrate) and 30% hydrogen peroxide were mixed in relation 2 g to 1 ml and creamy paste was prepared. Using plastic instrument, the material was applied in the pulp chamber, covered with cotton pellet (Figure 3) and temporarily closed using GIC (Figure 4). The same procedure was repeated every 7 days, in 4 time intervals (28 days).

Observation and color detection was analyzed after each application in order to avoid excessive bleaching. In order to neutralize acidic environment and prevent possible cervical resorption, after the completion of bleaching treatment the pulp chamber was cleaned, dried and suspension of calcium hydroxide was applied for 7 days. The cavity was closed using temporary material (Citodur, Galenika). Restoration of the tooth using composite filling (Tetric Ceram, Ivoclar, Vivadent) was performed 7 days after completion of bleaching treatment.

Color detection after treatment completion was carried out using Vita key and achieved color was A3.5. According to the manufacturer's instructions every Vita shade was assigned by a number from 1 to 16, lighter to darker color, lower numbers indicating lighter shade. The movement towards a brighter shade was carried out along the light-dark scale (Table 1). Bleaching therapy showed improvement for three shades in the light-dark scale from 15 to



**Figure 3.** Sodium perborate and 30% hydrogen peroxide mixture application

**Slika 3.** Nanošenje smese natrijum-perborata i tridesetoprocentnog vodonik-peroksida



**Figure 1.** Discolored maxillary right central incisor

**Slika 1.** Prebojeni gornji centralni desni sekutić



**Figure 4.** Temporary restoration placed (Citodur, Galenika)

**Slika 4.** Kavitet zatvoren privremenim ispunom (Citodur, Galenika)



**Figure 2.** Cavity preparation with applied GIC barrier

**Slika 2.** Otvoreni zubni kavitet sa glasjonomercementnom barijerom



**Figure 5.** Maxillary central incisor after treatment completion (three shades lighter)

**Slika 5.** Gornji centralni desni sekutić na kraju terapije (tri nijanse svetliji)

**Table 1.** Light-dark scale and code numbers for tooth shade determination  
**Tabela 1.** Svetlo-tamna skala za određivanje nijanse zuba i odgovarajući kod

Vita color Vita boja	B1	A1	B2	D2	A2	C1	C2	D4	A3	D3	B3	A3.5	B4	C3	A4	C4
Code number Kod	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

12 (Figure 5). On the control checkup one year after the treatment there was no further discoloration of the tooth.

## DISCUSSION

A variety of techniques can be used for bleaching of endodontically treated teeth. Ambulatory techniques (when high concentrations of hydrogen peroxide and carbamide peroxide are used) require different sources for gel activation: light, heat or laser. They are performed in one session and depending on the technique, time needed is about 30 to 45 minutes [7, 8]. Whitening of non-vital endodontically treated teeth can be done using "walking" bleach technique, which involves longer duration of therapy [9]. Assessment of aesthetic results of "walking" bleach technique before and after the treatment completion was performed by simultaneous comparison of tooth color with standardized color key. Color was determined using Vita key (Vita Zahnfabrik, Germany). The method of simultaneous comparison of tooth color with a standardized color key is one of the most common experimental models for color analysis. This method is available in almost every clinical practice, making it applicable in predicting clinical success of bleaching. The disadvantage of this method of simultaneous color comparison with a standardized color key is the inevitable subjectivity in color evaluation.

A great number of factors may affect the validity of results. Among these factors are: light conditions and room decor, experience, age, eye fatigue as well as individual perception of color experience [10]. Because of that, in this case, three therapists were involved in color determination before and after the treatment, using calibration exercise.

Cervical resorption is one of possible complications that can occur after bleaching therapy of non vital teeth [11]. To avoid cervical resorption, acidic environment in the tooth cavity after the completion of bleaching treatment should be neutralized by placing calcium hydroxide suspension for 7 days [12]. This time period is necessary for the release of remaining oxygen and dentin remineralization in order to stabilize color and provide adequate adhesion to the composite filling [12, 13].

The fact that longer time is needed for whitening teeth discolored by endodontic sealer (28 days) can be explained by information that pigments of natural origin (decom-

position products of blood elements, bacterial pigments, decomposition products of pulp etc.) are susceptible to oxidation reaction [8]. Tests have shown that pigments originating from biological compounds more easily enter into chemical reactions of degradation and need less time to convert than pigments of "artificial" sources [14].

With the development of modern cosmetic dentistry number of techniques that can successfully treat single tooth discoloration have become available. "Walking" bleach technique, although one of the oldest techniques is very efficient method to get desired results quickly, easily and economically acceptable.

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# Primena „šetajuće“ tehnike beljenja u izbeljivanju endodontski lečenih zuba – prikaz slučaja

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## KRATAK SADRŽAJ

**Uvod** Izbeljivanje depulpisanih zuba jeste tretman pojedinačnih diskoloracija čiji je cilj vraćanje estetske harmonije zubika. Jedna od često korišćenih tehnika izbeljivanja prebojenih endodontski lečenih zuba je i „šetajuća“ tehnika beljenja, koja je u mnogim slučajevima bila veoma uspešna. Cilj rada bio je da se prikažu mogućnosti i postupak izbeljivanja endodontski lečenog zuba primenom ove tehnike beljenja.

**Prikaz slučaja** Dvadesetdvogodišnja pacijentkinja se javila na kliniku zbog diskoloracije maksilarnog desnog centralnog sekutića. Izbeljivanje je urađeno primenom intrakoronarne postavke smese natrijum-perborata i tridesetoprocenatnog vodonik-peroksida. Sveže zamešena smesa materijala za beljenje nanošena je svakih sedam dana. Terapija je ukupno trajala 28 dana. Rezultat terapije izbeljivanja depulpisanog zuba bio je za tri nijanse svetliji zub u odnosu na boju zuba pre početka tretmana.

**Zaključak** Smesa natrijum-perborata i tridesetoprocenatnog vodonik-peroksida veoma uspešno izbeljuje depulpisane zube, prebojene kao posledica endodontskog silera.

**Ključne reči:** beljenje zuba; depulpisan zub; „šetajuća“ tehnika beljenja

## UVOD

Izbeljivanje prebojenih avitalnih zuba je veoma važan postupak u endodontskoj i estetskoj stomatologiji. Pojedinačno prebojeni zubi, pogotovo u predelu frontalne regije, veliki su estetski problem. Izbeljivanje avitalnih zuba podrazumeva primenu visokih koncentracija vodonik-peroksida ili karbamid-peroksida, što ovaj tretman svrstava u ambulantne metode beljenja.

Spaser (*Spasser*) [1] je 1961. godine preporučio primenu natrijum-perborata i vode za izbeljivanje depulpisanih zuba koji se nanose u komoru pulpe. Nating (*Nutting*) i Po (*Poe*) [2] su 1963. godine modifikovali ovu tehniku, vodu zamenili tridesetoprocenatnim vodonik-peroksidom, a novu tehniku nazvali „šetajuća“ tehnika. Agens za beljenje čini smesa natrijum-perborata i vode u odnosu 2:1 (g/ml), pri čemu se dobija bazan pH rastvora. Natrijum-perborat je beli kristalni prah koji se javlja u nekoliko oblika (u zavisnosti od količine vode koja se kristalizuje), i to kao natrijum-perborat monohidrat, trihidrat i tetrahidrat.

Razlog prebojavanja depulpisanih zuba može biti diseminacija produkata krvi u pulpnu komoru i dentinske kanalice usled traume, ali i posledica ekstirpacije pulpe ili zaostalog materijala za opturaciju u krunicnom delu komore tokom endodontskog lečenja. Najčešće dolazi do razgradnje produkata krvi (hemin, hemosiderin, hematoidin, hematorfirin,...) iz kojih se usled hemolize oslobađa gvožđe, koje u reakciji sa vodonik-sulfidom prelazi u crni gvožđe-sulfid i izaziva prebojenost zuba [3]. Razgradnja proteina nekrotične zubne pulpe je takođe veoma bitan faktor koji može dovesti do prebojenosti krunice zuba. Proteolitički procesi dovode do oslobađanja jedinjenja amino-kiselina, a lezija se ispunjava i novom hranom, u kojoj se nastavljaju proces truljenja i invazija novih bakterija [4]. Faktori koji dovode do moguće prebojenosti zuba jesu i materijali za opturaciju kanala korena, među kojima su AH-26, endometazon i jodoform-cement, ali i lekovi koji sadrže tetraciklin i jod [5]. Prebojenosti često nastaju i kao posledica metalnih jona koji potiču od srebrnih kočica i amalgama [6].

Cilj ovog rada bio je da se prikažu mogućnosti i postupak izbeljivanja endodontski lečenog zuba primenom „šetajuće“ tehnike beljenja.

## PRIKAZ SLUČAJA

Dvadesetdvogodišnja devojka se javila stomatologu zbog estetske smetnje izazvane diskoloracijom gornjeg desnog centralnog sekutića posle endodontskog lečenja. Boja ovog zuba bila je znatno tamnija od boje ostalih zuba gornje vilice (Slika 1). Na ostalim zubima uočene su i bele mrlje koje su dodatno narušavale estetski izgled zuba. Pacijentkinja je u anamnezi navela da bele mrlje na prednjim zubima ima od detinjstva. Na osnovu stomatološke anamneze i kliničkog pregleda utvrđeno je da je tri godine ranije na gornjem desnom centralnom sekutiću urađena endodontska intervencija. U stomatološkoj anamnezi nije dobio podatak o eventualnoj traumi zuba, a kliničkom i radiografskom analizom ustanovljena je adekvatna opturacija kanalnog sistema, te da ne postoji potreba za ponovnim tretmanom.

Nakon upoznavanja pacijentkinje s rizicima, mogućnostima i ograničenjima svih tretmana koji su dostupni u estetskoj sanaciji prebojenosti zuba, izabrana je intrakoronarna tehnika beljenja primenom smese natrijum-perborata i tridesetoprocenatnog vodonik-peroksida. Usledilo je uklanjanje mekih naslaga, starog kompozitnog ispuna sa palatinalne strane i otvaranje kaviteta, gde su na zidovima zatečeni ostaci endodontskog silera. Nakon temeljnog uklanjanja (čišćenja) paste sa zidova komore pulpe i koronarnog punjenja na 2 mm apikalno od gledno-cementne granice, postavljen je glasjonomer-cement (*Alfagal, Galenika*) u debljini od 1 mm (Slika 2).

Nakon određivanja boje prema Vita ključu (*Vita Zahnfabrik, Germany*), registrovana je boja zuba A4 i urađena fotografija pre tretmana. Potom su zamešeni natrijum-perborat (trihidrat) i tridesetoprocenatni vodonik-peroksid u odnosu 2 g prema 1 ml i dobijena je kremasta smesa. Plastičnim instrumentom

materijal je nanesen u komoru pulpe, prekriven kuglicom vate (Slika 3) i privremeno zatvoren glasjonomer-cementom (Slika 4). Isti postupak je ponovljen još tri puta, svakih sedam dana (do 28. dana).

Boja zuba je analizirana pri svakom nanošenju smese, kako bi se izbeglo preterano beljenje. Radi neutralisanja kisele sredine i sprečavanja eventualne cervikalne resorpcije, nakon završenog tretmana beljenja u ispranu i posušenu komoru pulpe postavljena je suspenzija kalcijum-hidroksida, a kavitet zatvoren privremenim ispunom (*Citodur*, *Galenika*) tokom sedam dana. Restauracija kompozitnim ispunom (*Tetric Ceram*, *Ivoclar*, *Vivadent*) usledila je nakon nedelju dana od završenog tretmana beljenja.

Boja zuba po završetku tretmana određena je pomoću Vita ključa, a postignuta boja bila je A3.5. Prema uputstvu proizvođača, svakoj nijansi dodeljeni su brojevi od 1 do 16, počevši od svetlije ka tamnijoj boji, pri čemu niži broj označava svetliju nijansu. Merenje vrednosti pomeranja ka svetlijoj nijansi vršeno je duž svetlo-tamne skale (Tabela 1). Rezultati tretmana ukazuju na kretanje u okviru svetlo-tamne skale od 15 do 12, što odgovara izbeljivanju tretiranog zuba za tri nijanse (Slika 5). Na kontrolnom pregledu posle godinu dana ustanovljeno je da nije došlo do promene boje zuba.

## DISKUSIJA

U procesu izbeljivanja endodontski lečenih zuba koriste se razne tehnike. Ambulantne tehnike (u kojima se primenjuju visoke koncentracije vodonik-peroksida i karbamid-peroksida) zahtevaju različite načine aktivacije gelova: svetlosne, toplotne i laserske. One se izvode u jednoj seansi i, u zavisnosti od tehnike, mogu trajati od 30 do 45 minuta [7, 8]. Tretman izbeljivanja depulpisanih zuba može se izvesti primenom „šetajuće“ tehnike izbeljivanja, koja podrazumeva višednevno trajanje terapije [9]. Procena estetskih rezultata ove tehnike beljenja pre i posle završenog tretmana vrši se metodom istovremenog poređenja

boje zuba sa standardizovanim ključem za boje. Boja je u prikazanom slučaju određivana pomoću Vita ključa za boje. Ova metoda je jedan od osnovnih eksperimentalnih modela za analizu promena boje. Dostupna je u skoro svakoj kliničkoj praksi, što je čini primenjivom u kliničkom predviđanju uspešnosti beljenja zuba. Nedostatak metode je, međutim, u neizbežnoj subjektivnosti ocene boje.

Veliki broj faktora može uticati na validnost dobijenih rezultata, kao što su: osvetljenje i dekor u prostoriji u kojoj se vrši poređenje, iskustvo stomatologa, starost, zamor oka i individualna percepcija doživljaja boje [10]. U prikazanom slučaju tri terapeuta su učestvovala u određivanju boje pre i posle tretmana, koristeći kalibracione vežbe.

Cervikalna resorpcija je moguća komplikacija koja se može javiti nakon tretmana beljenja depulpisanih zuba [11]. Da bi se izbegla njena pojava radi neutralizacije kisele sredine, po završenom tretmanu izbeljivanja u zubnu šupljinu se stavlja suspenzija kalcijum-hidroksida tokom sedam dana [12]. Ovaj vremenski period je neophodan zbog oslobađanja zaostalog kiseonika i remineralizacije dentina, kako bi se boja stabilizovala i obezbedila adekvatna adhezija s kompozitnim ispunom [12, 13].

To što je za izbeljivanje zuba koji je diskolorisan kao posledica endodontskog silera kod prikazane pacijentkinje bilo potrebno više vremena (28 dana) može se objasniti činjenicom da su pigmenti prirodnog porekla (raspadni produkti krvnih elemenata, bakterijski pigmenti, raspadni produkti pulpnog tkiva itd.) veoma lako podložni stupanju u hemijske reakcije u kojima oksidacijom dolazi do molekularne konverzije [8]. Ispitivanja su pokazala da pigmenti koji potiču od bioloških jedinjenja lakše ulaze u hemijske reakcije razgradnje od pigmenta tzv. veštačkog izvora, te je za njihovu reakciju konverzije potrebno kraće vreme nego za reakciju s pigmentima stranog porekla [14].

Razvojem savremene estetske stomatologije pojavio se veliki broj tehnika kojima se uspešno mogu tretirati prebojenosti pojedinačnih zuba. „Šetajuća“ tehnika beljenja zuba, iako jedna od najstarijih tehnika beljenja, veoma je efikasan način da se brzo, jednostavno i vrlo ekonomično dobiju željeni rezultati.