

Primljen/ Received on: 03.03.2017.
Revidiran/ Revised on: 21.03.2017.
Prihvaćen/ Accepted on:05.05.2017.

PRIKAZ SLUČAJA
CASE REPORT
doi:10.5937/asn1775718S

MOLARNO-INCIZIVNA HIPOMINERALIZACIJA: TERAPIJSKI IZAZOV U PEDONTOLOŠKOJ PRAKSI

MOLAR-INCISOR HYPOMINERALIZATION: THERAPEUTIC CHALLENGE TO PAEDIATRIC DENTISTRY PRACTICE

Branislava Stojković^{1,2}, Ljiljana Kostadinović^{1,2}, Marija Igić^{1,2}, Olivera Tričković Janjić^{1,2}, Simona Stojanović¹, Predrag Janošević^{1,3}

¹UNIVERZITET U NIŠU, MEDICINSKI FAKULTET U NIŠU, SRBIJA

²KLINIKA ZA STOMATOLOGIJU, PREVENTIVNA I DEČJA STOMATOLOGIJA, NIŠ, SRBIJA

³KLINIKA ZA STOMATOLOGIJU, ORTOPEDIJA VILICA, NIŠ, SRBIJA

¹UNIVERSITY OF NIŠ, FACULTY OF MEDICINE, NIŠ, SERBIA

²CLINIC OF DENTISTRY, PAEDIATRIC AND PREVENTIVE DENTISTRY, NIŠ, SERBIA

³CLINIC OF DENTISTRY, JAW ORTHOPEDICS, NIŠ, SERBIA

Sažetak

Uvod: Molarno-incizivna hipomineralizacija označava pojavu hipomineralizacije gleđi sistemskog porekla, koja zahvata od 1-4 prva stalna molara, a koja je često udružena sa promenama na stalnim sekutičima. Varijacije u kliničkoj manifestaciji, uz često prisutnu asimetriju, su razlog velikih varijacija u potrebama za terapijskim tretmanom ovih strukturnih gleđnih defekata.

Prikaz slučaja: Prikazana su dva pacijenta sa dijagnozom molarno-incizivne hipomineralizacije. Prvi pacijent, devojčica stara 6 godina, kod koje je dijagnostikovana blaga klinička forma, se stomatologu javila odmah nakon erupcije prih stalnih molara. Rana dijagnoza i blagovremena primena preventivno-profilaktičkih mera, uz blagu kliničku formu, su razlozi sprečavanja nastanka karijesa i daljeg širenja poseruptivnog odlamanja gleđi na zahvaćenim prvim stalnim molarima. Nasuprot prvom, drugi pacijent, devojčica stara 7,5 godina, je sa dijagnozom umerene molarno-incizivne hipomineralizacije. Kod nje je došlo do pojave karijesa na zubu 46, kao i komplikacija karijesa karijesa na zubu 36, koji je ekstrahiran vrlo brzo nakon erupcije.

Zaključak: Rana dijagnoza i težina kliničke slike su najznačajni faktori koji utiču na terapijski ishod u zbrinjavanju molarno-incizivne hipomineralizacije.

Cljučne reči: Molarno-incizivna hipomineralizacija, rana dijagnoza, terapijski tretman

Corresponding author

Branislava Stojković, DDS, PhD student
Faculty of Medicine Niš,
Dr Zoran Djindjić Bld 81, Niš, Srbija
E-mail: sbranislava@gmail.com

Summary

Introduction: Molar incisor hypomineralization indicates the appearance of enamel hypomineralization of systemic origin which occurs in 1-4 first permanent molars, which is often accompanied by changes on permanent incisors. Variations in clinical manifestation, together with commonly present asymmetry, are the reason for large variations in the needs for therapeutic treatment of these structural enamel defects.

Case study: Two patients with diagnosed molar incisor hypomineralization are shown. The first patient, a six-year-old girl, with diagnosed mild clinical form, visited the dentist immediately after the eruption of the first permanent molars. Early diagnosis and timely application of preventive-prophylactic measures, together with mild clinical form, are the reason for prevention of dental caries and further spreading of posteruptive enamel breakdown on affected first molars. Unlike the first one, the second patient, a 7,5-year-old girl had the diagnosis of moderate molar incisor hypomineralization. She developed dental caries on tooth 46 as well as complication in dental caries on tooth 36 which was extracted soon after the eruption.

Conclusion: Early diagnosis and the severity of clinical appearance are the most important factors which determine therapeutic outcome of the treatment of molar incisor hypomineralization.

Key words: molar incisor hypomineralization, early diagnosis, therapeutic treatment

© 2017 Faculty of Medicine in Niš. Clinic of Dentistry in Niš.
All rights reserved / © 2017. Medicinski fakultet Niš. Klinika
zastomatologiju Niš. Sva prava zadržana.

Uvod

Upotrebu termina "molarno-incizivna hipomineralizacija" (MIH) su u stomatološku praksu uveli Weerheijm i sar. 2001. godine da bi označili pojavu hipomineralizacije gleđi sistemske prirode, koja zahvata od 1-4 prva stalna molara, a koja je često udružena sa hipomineralizovanim promenama na stalnim sekutićima¹. Ubrzo nakon toga je istaknuto da se hipomineralizovane promene, osim na pomenutim zubima, istovremeno mogu javiti na ostalim stalnim zubima², zbog čega je upotreba ovog termina dovedena u pitanje. Međutim, sugerisano je da se termin MIH zadrži sve dok zvanično ne bude dokazano da promene nisu ograničene samo na prve stalne molare i sekutiće, kada će biti predložena revizija naziva ove pojave³.

Prevalencija MIH pokazuje veliku varijabilnost i kreće se u rasponu od 2,5% do 40,2%^{4,5}. Podaci o prevalenciji ovih defekata na ostalim stalnim zubima su oskudni, s obzirom da se epidemološka istraživanja najčešće rade u uzrastu kada ovi zubi još nisu nikli u ustima deteta⁶. Zvaničnih podataka o rasprostranjenosti MIH za našu zemlju nema, mada se procenjuje da iznosi oko 19,5%^{7,8}.

Osnovni patogenetski mehanizam MIH je poremećaj resorptivnog potencijala ameloblasta i inhibicija proteolitičkih enzima usled čega dolazi do zadržavanja gleđnih proteina, ometanja rasta kristala i maturacije gleđi⁹⁻¹⁴. Rezultat toga je promena u mineralnom sastavu gleđi, povećanje poroznosti, smanjenje tvrdoće i modula elastičnosti hipomineralizovane gleđi u odnosu na gleđ koja nije zahvaćena promenama, što se klinički manifestuje promenama u boji gleđi, koje variraju od beličastih do promena braon prebojenosti¹⁵⁻¹⁷. Osim toga, utvrđeno je da hipomineralizovana gleđ ima 3-15 puta veći sadržaj proteina u odnosu na normalnu gleđ.

Etiologija MIH još nije dovoljno jasna, mada je poznato da je MIH posledica sistemskog dejstva određenih faktora koji deluju u periodu mineralizacije prvih stalnih molara i inciziva, i to naročito onih koji deluju u toku prve godine života¹⁸. Do sada je opisan veliki broj potencijalnih faktora koji su prema vremenu delovanja podeljeni na prenatalne, perinatalne i postnatalne¹⁹. Nedavna istraživanja su sugerisala da je etiologija MIH multikazualna i da genetske varijacije u kombinaciji sa različitim faktorima sredine mogu igrati značajnu ulogu u nastanku ovih razvojnih gleđnih defekata²⁰.

Introduction

The term "Molar incisor hypomineralization" (MIH) was introduced in dental practice by Weerheijm et al. in 2001 to highlight the occurrence of enamel hypomineralization of systemic origin, that affects from 1-4 first permanent molars and is often accompanied with hypomineralized changes on permanent incisors¹. It was soon, after that, pointed out that hypomineralized changes, except on the aforementioned teeth, can simultaneously occur in other permanent teeth², thus questioning the use of this term. However, it was suggested that the term MIH be kept until officially proved that these changes are not limited only to first permanent molars and incisors, when the revision of the term would be suggested³.

The prevalence of MIH shows high variability and is in the range of 2.5% to 40.2%^{4,5}. Data on the prevalence of these defects on other permanent teeth are scarce, given that epidemiological research is most often conducted at the age when these teeth have not yet sprung out in the mouth of the child⁶. There are no official data on the prevalence of MIH for our country, but it is estimated to be approximately 19.5%^{7,8}.

The main pathogenic mechanism of MIH is the disorder of adsorbent potential of ameloblasts and inhibition of proteolytic enzymes, causing retention of enamel proteins, interfering with crystal growth and maturation of enamel⁹⁻¹⁴. This results in the transformation of mineral composition of the enamel, increase in porosity, decrease in hardness and elasticity module of hypomineralized enamel compared to the non-affected enamel, which is clinically manifested by changes in enamel colour that varies from whitish to changes of brown discoloration¹⁵⁻¹⁷. Besides, it is established that hypomineralized enamel had 3-15fold higher protein content than the normal enamel.

Etiology of MIH is still not clear enough, but it is known that MIH is a consequence of systemic effects of certain factors that act in the period of mineralization of first permanent molars and incisors, especially those factors that act in the first two years of life¹⁸. A large number of potential factors have been described until now, and they have been divided into prenatal, perinatal and postnatal according to the time of action¹⁹.

Klinička manifestacija MIH pokazuje veliku varijabilnost u broju zahvaćenih zuba i težini hipomineralizovanih promena. Prema težini kliničke slike, MIH je klasifikovana na blagu, umerenu i tešku formu²¹. Asimetrija je značajna karakteristika MIH i označava pojavu da je gleđ jednog prvog stalnog molara/inciziva zahvaćena više ili težom vrstom promena u odnosu na gleđ kontralateralnog prvog stalnog molara/inciziva^{7,22}. Promene na prvim stalnim molarima variraju od beličastih zamućenosti do teških hipomineralizovanih promena praćenih pucanjem gleđi, često već u toku nicanja zuba, te dentin ostaje nezaštićen, pa se karijesna lezija lako razvija. Promene na sekutićima su uglavnom u vidu ograničenih zamućenja gleđi, od bele do braonkaste prebojenosti, najčešće bez prekida kontinuiteta gleđi. Zubi zahvaćeni promenama mogu biti osetljivi na nadražaje, što može otežati održavanje oralne higijene i ishranu pacijenta.

Dijagnostičke kriterijume MIH postavili su 2003. godine Weerheijm i sar.: ograničena zamućenost, posteruptivno odlamanje gleđi, atipične restauracije, ekstrakcija prvog stalnog molara zbog MIH, neiznikao zub². Iako postavljanje dijagnoze ne predstavlja veći problem, u diferencijalnoj dijagnozi treba isključiti fluorozu zuba, strukturne defekte izazvane lokalnim faktorima, amelogenesis imperfecta, tetraciklinsku prebojenost, gleđnu hipoplaziju, karijes^{3,23}.

Budući da je veoma rano uočeno da zbrinjavanje MIH predstavlja izazov u svakodnevnom radu stomatologa i da je skopčano sa brojnim poteškoćama, velika pažnja je usmerena na pronalaženje terapijskih strategija u zbrinjavanju ovih gleđnih defekata.

Cilj ovog rada bio je da ukaže na značaj rane dijagnoze i značaj rane terapije molarno-incizivne hipomineralizacije.

Prikaz slučaja

Pacijent 1

Prvi prikazani pacijent je devojčica stara 6 godina, koja se u pratnji majke javila Službi za preventivnu i dečju stomatologiju Klinike za stomatologiju u Nišu zbog toga što je majka registrovala razliku u boji kvržica na zubu 36, sumnjajući na prisustvo karijesa na tom zubu. Kliničkim intraoralnim pregledom pacijenta, korišćenjem kriterijuma po Weerheijmu i sar.², dijagnostikovana je MIH, pri čemu su hipomineralizovane promene detektovane samo na zubima 36 i 46 u vidu beličasto-žučkastih promena.

Recent research has indicated that etiology of MIH is multicausal and that genetic variations can, in combination with different environmental factors, play a significant role in the occurrence of these structural enamel defects²⁰.

Clinical manifestation of MIH shows great variability in the number of affected teeth and severity of hypomineralized changes. According to the severity of clinical picture, MIH has been classified into mild, moderate and severe form²¹. Asymmetry is a significant characteristic of MIH and indicates that the enamel of the first permanent molar/incisor is more affected or is affected by more severe changes compared to the enamel of contralateral first permanent molar/incisor^{7,22}. Changes on first permanent molars vary from whitish blur to heavy hypomineralized changes accompanied by cracking enamel, often during teething, so dentine remains unprotected and the carious lesion is easily developed. Changes on incisors are usually in the form of limited bluish enamel, from white to brownish discoloration, most often without interruption in enamel continuity. Teeth affected by changes may be sensitive to stimuli, which can make it difficult to maintain oral hygiene and diet of the patient.

Diagnostic criteria for MIH were set in 2003, by Weerheijm et al.: demarcated opacity, posteruptive enamel breakdown, atypical restoration, extracted molar due to MIH, unerupted tooth². Although the diagnosis does not represent much of a problem, in differential diagnosis one should exclude dental fluorosis, structural defects caused by local factors, amelogenesis imperfecta, tetracycline discoloration, enamel hypoplasia, dental caries^{3,23}.

Since it has been established very early that taking care of MIH presents a challenge in everyday work of dentist, and that it features many difficulties, a huge amount of attention is directed to treatment of these enamel defects.

The aim of this study is to emphasize the importance of early diagnosis and early treatment of molar incisor hypomineralization.

Case study

Patient 1

The first presented patient is a 6-year-old girl, which, accompanied by her mother, visited the Department of Preventive and Paediatric Dentistry of Dental Clinic in Nis,

Na zubu 46 prisutan je blag prekid kontinuiteta gleđi. Promene nisu praćene subjektivnim tegobama, u smislu osetljivosti zuba na nadražaje. Anamnezom dobijenom od majke devojčice dobijen je podatak da kod devojčice nije dijagnostikovano nijedno hronično sistemsko oboljenje i da devojčica nije imala česte epizode febrilnih stanja tokom prvih godina života. Nakon dijagnostikovanja MIH, uklonjene su meke naslage sa zuba, izvršena lokalna fluorizacija zuba koncentrovanim fluoridima. Pacijentu je data instrukcija o tehnici, redovitosti, učestalosti i dužini pranja zuba, i preporučena upotreba preparata sa fluoridima prema važećem protokolu o primeni fluorida iz 2009. godine²⁴, zakazani redovni kontrolni pregledi. Godinu dana od postavljene dijagnoze MIH, na redovnom kontrolnom pregledu nije dijagnostikovana pojava karijesa na prvim stalnim molarima zahvaćenim hipomineralizovanim promenama kao i na ostalnim prisutnim stalnim i mlečnim zubima (Slika 1).



Slika 1. Zubi 36 i 46 sa beličasto-žučkastim hipomineralizovanim promenama
Figure 1. Teeth 36 and 46 with white-yellowish hypomineralized changes

Pacijent 2

Drugi prikazani pacijent je devojčica, stara 7,5 godina, koja se u pratnji majke javila Službi za preventivnu i dečju stomatologiju Klinike za stomatologiju u Nišu zbog sanacije karijesnih zuba. Kliničkim pregledom pacijenta, korišćenjem kriterijuma za dijagnozu po Weerheijmu i sar.², dijagnostikovana je MIH. Na zubima 16, 26, 46 registrovane su hipomineralizovane promene žučkasto-braonkaste prebojenosti (Slika 2). Na zubu 46 registrovane su braonkaste promene praćene prekidom kontinuiteta gleđi u distalnom delu krunice zuba, gde je dijagnostikovano prisustvo karijesa. Zubi zahvaćeni hipomineralizovanim promenama osetljivi su na termičke nadražaje. Zub 36 je ekstrahiran (Slika 3).

since the mother had registered the difference in colour of cusps on tooth 36, suspecting the presence of dental caries on that tooth. The use of clinical intraoral examination and criteria by Weerheijm et al.² helped to diagnose MIH with hypomineralized changes that were detected only on teeth 36 and 46 in the form of whitish-yellowish changes. The tooth 46 had slightly interrupted enamel continuity. The changes were not followed by subjective discomforts regarding sensitivity to stimuli. History, taken from the girl's mother, provided data that the girl had not been diagnosed with any chronic systemic disease, and that the girl had not had frequent episodes of febrile conditions during first years of life. After the diagnosis of MIH, soft layers were removed from the teeth, and local fluoridization was done by concentrated fluoride. The patient was instructed on the technique, frequency and duration of tooth brushing, the use of formulation with fluoride was recommended according to the current protocol on fluoride use from 2009²⁴, and regular check-ups were scheduled. During control check-up, one year after diagnosing MIH, there was no diagnosis of dental caries on first permanent molars as well as on other permanent and primary teeth affected by hypomineralized changes (Figure 1).

Patient 2

The second patient was a 7,5-year-old girl who, accompanied by her mother, visited the Department of Preventive and Paediatric Dentistry of Dental Clinic in Niš for the treatment of dental caries. Clinical examination of the patient, with the use of the diagnosing criteria according to Weerheijm et al.², resulted in diagnosing MIH. Teeth 16, 26, 46 had the presence of hypomineralized changes with brownish discolouration (Figure 2). The tooth 46 had hypomineralized changes with brownish discolouration followed by interrupted enamel continuity in the distal part of the tooth crown, where the presence of dental caries was diagnosed. The teeth with hypomineralized changes were sensitive to thermal stimuli. The tooth 36 was extracted (Figure 3). Teeth 11, 21 and 41 had whitish-yellowish hypomineralized changes without interrupted enamel continuity (Figure 4).

Na zubima 11, 21 i 41 registrovane su beličasto-žučkaste hipomineralizovane promene bez prekida kontinuiteta gleđi (Slika 4). Anamnezom uzetom od majke devojčice dobijen je podatak da je devojčica rođena u terminu, Carskim rezom, na rođenju normalne telesne mase. Od majke je dobijen anamnestički podatak o postojanju učestalih febrilnih stanja i čestoj upotrebi antibiotika u toku prve godine života devojčice. Nakon kliničkog pregleda pacijenta, uklonjene su meke naslage sa zuba i izvršena je sanacija karijesa na zubu 46 postavljanjem biološke paste na bazi kalcijum-hidroksida, a zub privremeno zatvoren glas-jonomer ispunom (Slika 2). Zbog hiperosektivnosti zuba 46, preparacija kaviteta II klase (okluzo-distalno) izvedena je u sprovodnoj-mandibularnoj analgeziji, ali zadovoljavajuća analgezija nije postignuta. Izvšena je lokalna fluorizacija zuba koncentrovanim fluoridima. Pacijentu je data instrukcija o tehnici, redovitosti, učestalosti i dužini pranja zuba, a preporučena je upotreba mekane četkice za zube. Takođe, preporučena je upotreba preparata sa fluoridima prema važećem protokolu o primeni fluorida iz 2009. godine²⁴, zakazan nastavak terapije i redovni kontrolni pregledi.

Diskusija

Pronalaženje adekvatnog terapijskog modela i strategija u zbrinjavanju MIH bio je čest predmet istraživanja, budući da zbrinjavanje MIH predstavlja izazov i da je skopčano sa brojnim poteškoćama kao što su osetljivosti zuba na različite nadražaje, rana pojava i brza progresija karijesa, otežano postizanje lokalne analgezije, otežano postizanje adhezije restaurativnih materijala i učestalo marginalno pucanje postavljenih ispuna¹⁰. Osim toga, hipomineralizovane promene lokalizovane na frontalnim zubima narušavaju estetski izgled deteta, što se može negativno odraziti na njegov socijalni život. Osetljivost zuba na nadražaje je u direktnoj vezi sa težinom kliničke slike, i rezultat je subkliničke inflamacije pulpe, koja nastaje bez prethodne pojave karijesa²⁵. Pojedini autori su utvrdili da oralne bakterije mogu da penetriraju kroz hipomineralizovanu gleđ u dentinske kanaliće i izazovu inflamatornu reakciju pulpe, koja može doprineti hiperosektivnosti zuba sa MIH³⁸. Osetljivost zuba na nadražaje otežava održavanje oralne higijene i ishranu deteta, što olakšava akumulaciju dentalnog plaka, koji zajedno sa

History, taken from the girl's mother, provided the data that the girl was born at term by a Caesarean section and was of normal birth weight. The mother provided information on girl's frequent febrile conditions and frequent use of antibiotics within the first year of her life. After clinical examination, soft layers were removed from the teeth and the dental caries were treated on tooth 46 by setting a biological paste containing calcium hydroxide, and the tooth was temporarily closed with glass-ionomer fillings (Figure 2). Due to hypersensitivity of the tooth 46, the preparation of class II cavity (occlusion-distal) was done in conductive-mandibular analgesia, but satisfactory analgesia was not achieved. Local fluoridization was done by concentrated fluoride. The patient was instructed on the technique, frequency and duration of tooth brushing and the use of soft toothbrush was recommended. The use of formulation with fluoride was also recommended according to the current protocol on fluoride use from 2009²⁴, and further treatment and regular check-ups were scheduled.



Slika 2. Hipomineralizovani prvi stalni molari 16,46

Figure 2. Hypomineralized first permanent molars 16,46

Discussion

Finding adequate therapeutic models and strategies in managing MIH was a frequent research subject since MIH treatment is a challenge and is intertwined with numerous difficulties such as teeth sensitivity to different stimuli, early occurrence and rapid progression of dental caries, difficulty in achieving local analgesia, difficulty in achieving adhesion of restorative materials



Slika 3. Ekstrahiran zuba 36 - rezultat komplikacija karijesa na zubu zahvaćenom hipomineralizovanim promenama
Figure 3. Extracted tooth 36 - the result of caries complications on the tooth with hypomineralized changes



Slika 4. Beličasto-žučkaste hipomineralizovane promene na stalnim sekutićima (11, 21, 41)
Figure 4. White-yellowish hypomineralized changes on permanent incisors 11,21,41

oslabljenom strukturom zuba doprinosi lakšoj pojavi i bržoj progresiji karijesa. Iako je utvrđena signifikantna povezanost između MIH i pojave karijesa, neke studije su potvrdile da su neophodne dobro dizajnirane studije koje bi ovu povezanost i potvrdile³⁶.

Postizanje lokalne analgezije kod ove grupe pacijenata je otežano, mada tačan mehanizam tome nije poznat. Imunocitohemijska istraživanja Rodd i sar. su pokazala da hipomineralizovani prvi stalni molari pokazuju promene u inervaciji pulpe, vaskularizaciji, akumulaciji imunoloških ćelija koje su indikativne za inflamatorni odgovor²⁶. Nalazi ovih autora bi delimično objasnili zašto postizanje lokalne analgezije kod ovih pacijenata može biti otežano. Neki autori su mišljenja da određeni broj pacijenata sa MIH zahteva zbrinjavanje zuba u opštoj anesteziji²⁷. Kod pacijenata sa MIH, osetljivost zuba, rana pojava karijesa i otežano postizanje analgezije su glavni uzroci straha od stomatoloških intervencija i njihovo izbegavanje.

and frequent marginal cracks on set fillings¹⁰. In addition, hypomineralized changes localized on the front teeth disturb aesthetic appearance of the child and may negatively affect his/her social life. Tooth sensitivity to stimuli is directly connected to the severity of clinical picture, and it is the result of subclinical inflammation of the pulp, which appears²⁵ without the occurrence of dental caries²⁵. Some authors have found that oral bacteria may penetrate the hypomineralized enamel into the dentinal tubules and cause inflammatory reactions in the pulp, which can contribute to hypersensitivity of teeth with MIH³⁸. Tooth sensitivity to stimuli hinders maintenance of oral hygiene and diet of a child, thus facilitating accumulation of dental plaque, which, together with weakened tooth structure, contributes to easier occurrence and faster progression of dental caries. Although a significant association between MIH and caries was found, some studies confirmed the need for well-designed studies to provide evidence of this association³⁶.

Achieving local analgesia in this group of patients is difficult, although the exact mechanism for this is not known. Immunocytochemical investigations of Rodd et al. have shown that hypomineralized first permanent molars demonstrated changes in pulpal innervation, vascularity and accumulation of immune cells which are indicative of an inflammatory response²⁶. The findings of these authors could partly explain why the achievement of local analgesia in these patients may be difficult. Some authors are of the opinion that a certain number of patients with MIH require dental care under general anaesthesia²⁷. In patients with MIH, tooth sensitivity, early dental caries, and difficulty in achieving analgesia are the main causes of fear of dental procedures and their avoidance. The need for therapeutic treatment shows great variations and is ranked from prevalence, through restoration to extraction³, whereby in some cases there is a need to satisfy functional and other aesthetic demands. The choice of therapeutic treatment depends on severity of clinical picture, number of affected teeth, degree of child's cooperativeness, age when consulting the dentist, social-economic status, and the need for orthodontic treatment³. There is no universal guide, but numerous therapeutic approaches and strategies in treating MIH have been described up to now.

Potrebe za terapijskim tretmanom pokazuju velike varijacije i rangirane su od prevencije, preko restauracije do ekstrakcije³, pri čemu u pojedinim slučajevima treba zadovoljiti funkcionalne, a u drugim estetske zahteve. Izbor terapijskog tretmana zavisi od težine kliničke slike, broja zahvaćenih zuba, stepena saradljivosti deteta, uzrasta kada se javilo stomatologu, socio-ekonomskog statusa, potrebe za ortodontskim tretmanom³. Univerzalni vodič ne postoji, ali je do sada opisan veći broj terapijskih pristupa i strategija u zbrinjavanju MIH. Terapijski pristup koji su predložili William i sar.¹⁰ 2006. godine obuhvata identifikaciju faktora rizika koji dovode do nastanka MIH, ranu dijagnostiku, remineralizaciju i desenzitizaciju, prevenciju karijesa i posteruptivnog odlamanja gleđi, restauraciju i ekstrakciju i održavanje postignutih rezultata. Mathu-Muju i Wright²⁸ su iste godine predložili terapijski pristup baziran na težini kliničke slike, dok su Lygidakis i sar.³ 2010. godine predložili pristup koji je baziran na tipu denticije i težini kliničke slike.

Identifikacija deteta koje je u riziku od pojave MIH bi bila od velikog značaja, jer bi omogućila ranu dijagnozu MIH, a time i blagovremenu primenu preventivnih mera. Međutim, nju otežava činjenica da etiološki faktori koji dovode do pojave MIH još uvek nisu jasno determinisani. Literaturni podaci ukazuju da se sa nastankom MIH najčešće povezuju hipoksična stanja u zadnjem mesecu trudnoće, prevremeno rođenja deca, učestale epizode febrilnih stanja i česta upotreba antibiotika u najranijem detinjstvu, astma, deficit vitamina D, poremećaji metabolizma kalcijuma i fosfata, zbog čega se pobrojani faktori mogu koristiti za identifikaciju osoba koje su u riziku za pojavu MIH. Neophodne su dalje prospektivne studije koje će rasvetliti etiologiju ove pojave i time omogućiti ranu identifikaciju osoba koje su u riziku od pojave MIH.

Rana dijagnostika MIH bi omogućila primenu odgovarajućih mera koje imaju za cilj da spreče rani gubitak tvrdih zubnih tkiva i pojavu karijesa, kao i da ublaže osetljivost zuba na različite nadražaje¹⁰. Istovremeno, rana dijagnostika bi omogućila rani tretman zuba, čime bi se smanjila potreba za tretmanom, a mogućnost pojave komplikacija koje mogu uzrokovati ekstrakciju zuba bi se svela na minimum. Za ranu dijagnostiku MIH neophodni su redovni kontrolni pregledi, naročito u periodu kada se očekuje erupcija prvih stalnih molara i sekutića, što odgovara periodu od 5. do 7. godine života.

Therapeutic approach suggested by William et al.¹⁰ in 2006 includes identification of risk factors which lead to the occurrence of MIH, early diagnosis, remineralization and desensitization, prevention of dental caries and post-eruptive breakage of enamel, restoration and extraction, as well as maintenance of achieved results. The same year, Mathu-Muju and Wright²⁸ suggested therapeutic approach based on the severity of clinical picture, while Lygidakis et al.³ in 2010 suggested the approach based on the type of dentition and severity of clinical picture.

Identification of the child that is at risk of MIH would be extremely important since it would enable early diagnosis of MIH and, at the same time, timely implementation of preventive measures. However, this is aggravated by the fact that etiologic factors which lead to MIH occurrence are still not clearly determined. Literature data indicate that formation of MIH is most often connected with hypoxic conditions in the last month of pregnancy, preterm birth, frequent febrile conditions and frequent use of antibiotics in the earliest childhood, asthma, deficiency of vitamin D, metabolic disorders of calcium and phosphate which is why the listed factors can be used to identify people who are at risk of MIH occurrence. There is a need for prospective studies to elucidate the aetiology of this phenomenon, and thereby enable early identification of people at risk of developing MIH.

Early diagnostics of MIH would enable the application of appropriate measures that are intended to prevent the early loss of dental hard tissues and dental caries, as well as to alleviate tooth sensitivity to different stimuli¹⁰. At the same time, early diagnostics would enable early treatment of teeth which would decrease the need for retreatment thus reducing the possibility of complications leading to teeth extraction to minimum. Early diagnostics of MIH demands regular check-ups, especially in the period when eruption of first permanent molars and incisors is expected, which is usually in the age of 5 to 7 years. Additionally, parents' knowledge on this type of defects would be of great help. This study describes the case of a girl with early diagnosed mild form of MIH, immediately after tooth eruption. In these patients it is recommended that oral hygiene, is performed by using a soft brush, it is advisable to use local low-concentrated fluoride, to apply formulations based on casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), undergo professional

Osim toga, od velike pomoći bi bila i informisanost roditelja o ovoj vrsti defekata. U ovom radu opisan je slučaj devojčice kod koje je blaga forma MIH rano dijagnostikovana, neposredno nakon erupcije zuba. Kod ovakvih pacijenata preporuka je da se oralna higijena obavlja upotrebom mekane četkice za zube, savetuje se lokalna upotreba niskokontcentrovanih fluorida, aplikovanje preparata na bazi kazein fosfopeptidamorfog kalcijum fosfata (CPP-ACP), profesionalna aplikacija visoko koncentrovanih fluorida u vidu lakova, zalivanje fisura^{3,10}. Preporuka je da se fisure najpre zaliju GJC zalivačima, koji će kasnije biti zamenjeni kompozitnim. Zbog karakteristika hipomineralizovanih promena i loše adhezije materijala, neophodno je redovno kontrolisati zalivače i ukoliko dođe do pucanja ili ispadanja, postupak zalivanja fisura treba ponoviti. U opisanom prvom slučaju dat je savet o održavanju higijene i izvršena je primena preparata fluorida prema važećem protokolu iz 2009. godine²⁴. Pacijent je redovno kontrolisan, motivisan i remotivisan, te na redovnom kontrolnom pregledu, godinu dana kasnije, na zubima zahvaćenim promenama nije dijagnostikovana karijes i širenje posteruptivnog odlamanja gleđi.

Međutim, rana dijagnoza MIH može biti od značaja kada se pacijent stomatologu javi na vreme, pre nego se javi potreba za klasičnim konzervativnim tretmanom, što u praksi nažalost nije slučaj. Osim toga, rana dijagnoza je od značaja samo kod lakših formi MIH, jer u umerenim i teškim kliničkim formama, već u toku erupcije zuba, dolazi do značajnog posteruptivnog odlamanja gleđi i pojave karijesa, što zahteva konzervativno zbrinjavanje, a često i ekstrakciju zuba. U drugom opisanom slučaju, devojčica se stomatologu javila kada su se komplikacije već javile, u smislu pojave karijesa na zubu 46, koji zahteva klasičan restaurativni tretman nakon terapije dubokog karijesa. Zub 36 je rano ekstrahiran, zbog, po rečima majke, velike destrukcije krunice zuba usled karijesa i rane pojave komplikacija karijesa na tom zubu.

Nedavno istraživanje je pokazalo da postoji veliki disparitet među kliničarima u pogledu načina zbrinjavanja zuba sa MIH³⁹. Zbrinjavanje prvih stalnih molara zahvaćenih hipomineralizovanim promenama može predstavljati veliki problem zbog otežanog postizanja adhezije restaurativnih materijala i učestalog marginalnog pucanja postavljenih ispuna, zbog čega se često javlja potreba za retreatmanom²⁹.

application of highly concentrated fluoride in the form of varnish, conduct sealing of fissures^{3,10}.

It is recommended that fissures are initially sealed with GIC sealants, which will later be replaced by composit-resins ones. Because of characteristics of hypomineralized changes and poor material adhesion, it is necessary to control sealants, and the procedure of fissure-sealing must be repeated, in case of breakage or failure. In the first described case, the advice on maintaining hygiene is given, and the application of fluoride formulations, according to the Protocol of 2009, was conducted²⁴. The patient had regular check-ups, was motivated and re-motivated and regular check-up after one year showed that teeth affected by changes had no dental caries or expansion of post-eruptive enamel breakage.

However, early diagnosis of MIH may be significant when the patient timely addresses the dentist before there is a need for classic, conservative treatment, which, unfortunately, is not usually the case. Apart from that, early diagnosis is significant only in mild forms of MIH, since in moderate and severe clinical form during eruption, there is significant posteruptive enamel breakdown and appearance of dental caries, which demands conservative treatment or often tooth extraction. The other case describes a girl who came to the dentist after the complications had appeared in the sense of dental caries on tooth 46 which calls for classic restorative treatment after the therapy of deep dental caries. Tooth 36 was early extracted because of, according to mother's words, huge destruction on tooth's crown due to dental caries and early occurrence of dental caries complications.

Recent investigation shows that there is a wide disparity between clinicians' views on how MIH-affected teeth should be treated³⁹. Treatment of first permanent molars affected by hypomineralized changes may present a huge problem due to difficulty of achieving adhesion of restorative materials and frequent marginal breakage of set fillings, which frequently results in need for retreatment²⁹.

Due to the great significance of the first permanent molars, it is recommended that these teeth are treated in a conservative manner whenever possible. Atypical forms of cavities are characteristic for MIH and two approaches are presented regarding cavity preparation: one that involves removing only the porous enamel, and another, more radical, which involves the healthy tissue^{3,10}.

Zbog višestrukog značaja prvih stalnih molara, preporuka je da se ovi zubi konzervativno zbrinu kada god je to moguće. Za MIH su karakteristični kaviteti atipičnih oblika, a opisana su dva pristupa u preparaciji kaviteta: jedan koji podrazumeva uklanjanje samo porodne gleđi i drugi koji je radikalniji i koji podrazumeva uklanjanje celokupne defektne gleđi do zdravog tkiva^{3,10}. Materijal izbora za restauraciju su materijali na bazi kompozitnih smola, kod kojih su preporučivani različiti pretretmani, sa ciljem da se poveća adhezija materijala za hipomineralizovanu gleđ^{28,30,31}. Upotreba glas jonomer cemenata ograničena je samo na privremeno zatvaranje kaviteta i u situacijama kad je kontrolisanje vlage otežano, dok upotreba amalgama, zbog njihove neadhezivnosti, nije indikovana. U težim slučajevima, za zbrinjavanje hipomineralizovanih promena na prvim stalnim molarima mogu se uspešno koristiti i metalne krunice^{32,33}, a opisana je mogućnost protetske rehabilitacije zuba, mada je njihova primena u dečjem uzrastu prilično ograničena.

Ekstrakcija prvih stalnih molara je često terapija izbora u zbrinjavanju MIH, naročito u težim slučajevima. Međutim, konačnu odluku o ekstrakciji ovih zuba treba doneti u konsultaciji sa ortodontom, te je multidisciplinarni pristup u zbrinjavanju MIH od velikog značaja.

Promene na stalnim sekutićima narušavaju estetiku izgled pacijenta, a njihovo zbrinjavanje zavisi od težine kliničke slike. Prilikom izbora načina zbrinjavanja hipomineralizovanih promena na sekutićima treba imati u vidu da žućkasto-bronkasti defekti zahvataju celu debljinu gleđi, dok su beličasti defekti manje porozni i variraju u debljini³⁴. U lakšim slučajevima, kada estetika nije mnogo ugrožena i kada nije došlo do prekida kontinuiteta gleđi, preporučuje se upotreba kazein fosfopeptida-amorfnog kalcijum fosfata i visoko koncentrovanih fluorida u cilju remineralizacije i smanjenja osetljivosti zuba na nadražaje, kao i tretman mikroabrazijom i izbeljivanjem¹⁰. Ukoliko je došlo do prekida kontinuiteta gleđi, ili zbog narušenog estetskog izgleda deteta, hipomineralizovanu promenu je moguće zbrinuti klasičnim konzervativnim tretmanom kompozitnim smolama ili vinirima, mada njihova upotreba u dečjem uzrastu može biti ograničena. Takođe je istaknuta i upotreba infiltracije smolom u zbrinjavanju ovih defekata. Iako je utvrđeno da infiltrati smolom mogu da prodru u MIH lezije i da utiču na obim lezije, promene u tvrdoći, rezultati u tom smislu su nepredvidivi³⁵.

The material of choice for restoration is resin-composite materials, in which various pre-treatments have been recommended in order to increase their adhesion to hypomineralized enamel^{28, 30, 31}. The use of glass ionomer cements is limited to the temporary closure of the cavity and in situations where it is difficult to control the moisture, while the use of amalgams due to their lack of adhesion is not indicated. Metal crowns can successfully be used in severe cases of treating hypomineralized changes on the first permanent molars^{32, 33}, and there is a possibility of prosthetic rehabilitation of teeth, although their use in children is rather limited.

Extraction of first permanent molars is a commonly chosen therapy when treating MIH, especially in severe cases. However, the final decision on the extraction of these teeth should be made in consultation with the orthodontist, and a multidisciplinary approach to their care is of great importance.

Changes on permanent incisors ruin aesthetic appearance of the patient and their treatment depends on severity of clinical picture, but it should be borne in mind that the yellowish-brownish defects occupy the entire thickness of the enamel, while whitish defects are less porous and vary in thickness³⁴. In mild cases, when aesthetics is not much affected and when there has been no interruption in continuity of the enamel, the use of casein phosphopeptide-amorphous calcium phosphate and highly concentrated fluoride is recommended in order to remineralize and reduce tooth sensitivity to stimuli, as well as the treatment of micro abrasion and bleaching¹⁰. If there is an interruption in continuity of the enamel, or because of poor aesthetic appearance of the child, a hypomineralized change can be treated with classic conservative treatment with composite resins or veneers although their use in children may be limited. The use of resin infiltration is also highlighted in the treatment of these defects. Although it was determined that resin infiltrates can penetrate into the MIH lesions and may affect the extent of lesions, changes in hardness, the results in this regard are unpredictable³⁵. In addition to aesthetic interference, hypomineralized defects on incisors cause difficulty in adhesion of orthodontic brackets, and if there is a need for setting fixed orthodontic apparatus, a pre-treatment of hypomineralized enamel is recommended in order to increase the adhesiveness of hypomineralized enamel.

Osim estetskih smetnji, hipomineralizovani defekti na sekutićima izazivaju i poteškoće u adheziji ortodontskih bravica, te se, ukoliko postoji potreba za postavljanjem fiksnog ortodontskog aparata, preporučuje pretretman hipomineralizovane gleđi u cilju povećanja adhezivnosti za hipomineralizovanu gleđ.

Zaključak

Zbrinjavanje molarno-incizivne hipomineralizacije i dalje predstavlja veliki izazov u svakodnevnoj pedontološkoj praksi. Izbor terapijskog tretmana i terapijski ishod zbrinjavanja MIH su uslovljeni velikim brojem faktora, a može se smatrati da rana dijagnoza i težina kliničke slike u tom smislu igraju presudnu ulogu. Rana dijagnoza MIH bi omogućila blagovremenu primenu mera koje imaju za cilj da spreče rani gubitak tvrdih zubnih tkiva i pojavu karijesa, da ublaže osetljivost zuba na nadražaje, a istovremeno bi omogućila rani tretman, čime bi se smanjila potreba za retretmanom i mogućnost pojava komplikacija koje mogu biti uzrok ekstrakciji zuba. Za ranu dijagnostiku MIH neophodni su redovni kontrolni pregledi, naročito u periodu kada se očekuje erupcija prvih stalnih molara i sekutića, a od velike pomoći bi bila i informisanost roditelja o ovoj vrsti defekata.

Conclusion

Treatment of molar-incisor hypomineralization still presents a big challenge in everyday practice of paediatric dentistry. The choice of therapeutic treatment and the results of treating MIH are conditioned by numerous factors, and it can be considered that early diagnosis and severity of clinical picture in that sense play a crucial role. Early diagnosis of MIH would enable timely implementation of measures in order to prevent early loss of hard tooth tissues and occurrence of dental caries, reduce sensitivity to stimuli and, at the same time, enable early treatment thus reducing the need for re-treatment and reducing the possibility of complications that can cause extraction of teeth. Early diagnosis of MIH calls for regular check-ups, especially in the period when eruption of first permanent molars and incisors is expected and parents' knowledge on this type of defects would be of great help.

LITERATURA / REFERENCES

1. Weerheijm KL, Jälevik BA, Alaluusua S. Molar-incisor hypomineralisation. *Caries Res* 2001; 35(5):390-1.
2. Weerheijm KL, Duggal M, Mejare I, Papagiannoulis L, Koch G, Martens LC, et al. Judgement criteria for molar incisor hypomineralization (MIH) in epidemiologic studies: a summary of the European meeting on MIH held in Athens, 2003. *Eur J Paediatr Dent* 2003;4:110-113.
3. Lygidakis NA, Wong F, Jälevik B, et al. Best clinical practice guidance for clinicians dealing with children presenting with molar-incisor-hypomineralisation (MIH): an EAPD policy document. *Eur Arch Paediatr Dent*. 2010;11(2):75-81.
4. Cho SY, KI Y, Chu V. Molar incisor hypomineralization in Hong Kong Chinese children. *International Journal of Paediatric Dentistry* 2008; 18(5):348-352.
5. Soviero V et al. Prevalence and distribution of demarcated opacities and their sequelae in permanent 1st molars and incisors in 7 to 13-year-old Brazilian children. *Acta Odontologica Scandinavica* 2009; 67(3): 170-175.
6. Schmalfuss A et al. Canines are affected in 16-year-olds with molar-incisor hypomineralisation (MIH): an epidemiological study based on the tromsø study: "fit futures". *European archives of paediatric dentistry* 2016; 17(2): 107-113.
7. Ivanović M et al. Treatment options for hypomineralized first permanent molars and incisors. *Stomatološki glasnik Srbije* 2006; 53(3):174-180.
8. Ivanović M, Živojinović V, Vučetić M. Molar Incisor Hypomineralisation, 10th Congress of the Bass, Belgrade. *Balkan Journal of Stomatology* 2005; 9:40.
9. Farah RA, Monk BC, Swain MV, Drummond BK. Protein content of molar-incisor hypomineralisation enamel. *J Dent* 2010;38:591-6.
10. William V, Messer LB, Burrow MF. Molar incisor hypomineralization: review and recommendations for clinical management. *Pediatric dentistry* 2006; 28(3): 224-232.
11. Wright JT, Hall K, Yamauchi M. The protein composition of normal and developmentally defective enamel. *Ciba Found Symp* 1997;205:85-99.
12. Suga S. Enamel hypomineralization viewed from the pattern of progressive mineralization of human and monkey developing enamel. *Adv Dent Res* 1989;3:188-198.
13. Sato K, Hattori M, Aoba T. Disturbed enamel mineralization in a rat incisor model. *Adv Dent Res* 1996;10:216-224.
14. Robinson C, Brookes SJ, Bonass WA, Shore RC. Enamel maturation. *Ciba Found Symp* 1997;205:156-174.
15. Martinović B et al. Analysis of the mineral composition of hypomineralized first permanent molars. *Vojnosanitetski pregled* 2015; 72(10): 864-869.
16. Fagrell TG et al. Chemical, mechanical and morphological properties of hypomineralized enamel of permanent first molars. *Acta Odontologica Scandinavica* 2010; 68(4): 215-222.
17. Mahoney EK. Mechanical properties and microstructure of hypomineralized enamel of permanent teeth. *Biomaterials* 2004;25:5091-5100.
18. Reid D J, Dean M C. Variation in modern human enamel formation times. *J Hum Evol* 2006; 50: 329-46
19. Lygidakis NA, Dimou G, Marinou D. Molar-incisor-hypomineralisation (MIH). A retrospective clinical study in Greek children. II. Possible medical aetiological factors. *European Archives of Paediatric Dentistry* 2008; 9(4): 207-217.
20. Jeremias F et al. Genes expressed in dental enamel development are associated with molar-incisor hypomineralization. *Archives of oral biology* 2013; 58(10):1434-1442.
21. Leppäniemi A, Lukinmaa PL, Alaluusua A. Nonfluoride hypomineralizations in the permanent first molars and their impact on the treatment need. *Caries Res* 2001;35:36-40.
22. Ivanović M et al. Hipomineralizacija na prvim stalnim molarima i incizivima. *Srpski arhiv za celokupno lekarstvo* 2007; 135 (7-8): 412-477.
23. Mast P et al. Understanding MIH: definition, epidemiology, differential diagnosis and new treatment guidelines. *Eur J Paediatr Dent* 2013; 14 (3): 204-8.
24. Ivanović M i sar. Protokol o primeni fluorida. Beograd: Stomatološki fakultet Univerziteta u Beogradu; 2009.
25. Jälevik, B et al. The prevalence of demarcated opacities in permanent first molars in a group of Swedish children. *Acta Odontologica Scandinavica* 2001; 59(5): 255-260.
26. Rodd HD, Boissonade FM, Day PF. Pulpal status of hypomineralized permanent molars. *Pediatric dentistry* 2007; 29(6): 514-520.
27. Jälevik B, Klingberg G. Treatment outcomes and dental anxiety in 18-year-olds with MIH, comparisons with healthy controls—a longitudinal study. *International journal of paediatric dentistry* 2012; 22(2): 85-91.
28. Jälevik B, Klingberg GA. Dental treatment, dental fear, and behaviour management problems in children with severe enamel hypomineralization of their first permanent molars. *Int J Pediatr Dent* 2002;12:24-32
29. Mathu-Muju K, Wright JT. Diagnosis and treatment of molar incisor hypomineralisation. *Compend Contin Educ Dent* 2006; 27(11): 604-10.
30. N.A. Lygidakis, G. Dimou, E. Stamataki. Retention of fissure sealants using two different methods of application in teeth with hypomineralised molars (MIH): a 4 year clinical study, *Eur. Arch. Paediatr. Dent.* 10 (2009) 223-226.
31. N.A. Lygidakis, A. Chaliasou, G. Siounas. Evaluation of composite restorations in hypomineralised permanent molars: a four year

- clinical study, *Eur. J. Paediatr. Dent.* 4 (2003) 143–148.
32. Mejare I, Bergman E, Grindefjord M. Hypomineralized molars and incisors of unknown origin: treatment outcome at age 18 years. *Int J Paediatr Dent* 2005; 15: 20–28.
33. Zagdwon AM, Fayle SA, Pollard MA. A prospective clinical trial comparing preformed metal crowns and cast restorations for defective first permanent molars. *Eur J Paediatr Dent* 2003; 4 : 138–142.
34. Jalevik B, Noren J G. Enamel hypomineralisation of permanent first molars: a morphological study and survey of possible aetiological factors. *Int J Paediatr Dent* 2000; 10: 278-289.
35. Crombie F, Manton, D, Palamara J, Reynolds E. Resin infiltration of developmentally hypomineralised enamel. *International journal of paediatric dentistry* 2014; 24(1), 51-55.
36. Americano GCA et al. A systematic review on the association between molar incisor hypomineralization and dental caries. *International Journal of Paediatric Dentistry* 2017; 27(1):11-21.
37. Silva MJ et al. Etiology of molar incisor hypomineralization—A systematic review. *Community dentistry and oral epidemiology* 2016; 44(4): 342-353.
38. Fagrell TG., et al. Bacterial invasion of dentinal tubules beneath apparently intact but hypomineralized enamel in molar teeth with molar incisor hypomineralization. *International Journal of Paediatric Dentistry* 2008; 18.5: 333-340.
39. Kopperud SE, Pedersen CG, Espelid, I. Treatment decisions on Molar-Incisor Hypomineralization (MIH) by Norwegian dentists—a questionnaire study. *BMC Oral Health* 2016; 17(1): 3.