

Primljen / Recived on: 20.03.2018
Prihvaćen / Accepted on : 07.04.2018

INFORMATIVNI RAD
INFORMATIVE ARTICLE
doi: 10.5937/asn1877832S

ZNAČAJ I MOGUĆNOSTI PROCENE RIZIKA ZA NASTANAK KARIJESA KOD DECE

SIGNIFICANCE AND POSSIBILITIES OF CARIES RISK ASSESSMENT IN CHILDREN

*Branislava Stojković^{1,2}, Marija Igić^{1,2}, Olivera Tričković-Janjić^{1,2}, Simona Stojanović³,
Marija Topalović⁴*

¹ UNIVERZITET U NIŠU, MEDICINSKI FAKULTET NIŠ, SRBIJA

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

³ UNIVERZITET U NIŠU, MEDICINSKI FAKULTET, PREDMET ORALNA HIRURGIJA, NIŠ, SRBIJA

⁴ UNIVERZITET U NIŠU, MEDICINSKI FAKULTET, STUDENT NA DOKTORSKIM STUDIJAMA

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

² CLINIC FOR DENTISTRY, CHILD AND PREVENTIVE DENTISTRY, NIŠ, SERBIA

³ UNIVERSITY OF NIŠ, FACULTY OF MEDICINE, ORAL SURGERY DEPARTMENT, NIŠ, SERBIA

⁴ UNIVERSITY OF NIŠ, FACULTY OF MEDICINE, PHD STUDENT

Sažetak

Uvod: Procena rizika za nastanak karijesa se definiše kao proces utvrđivanja verovatnoće da će se kod neke osobe tokom određenog vremena razviti nova karijesna lezija, i/ili kao verovatnoća da će kod postojećih lezija doći do promene u težini i/ili aktivitetu, i predstavlja osnovni preduslov efikasne prevencije karijesa. Poslednjih decenija akcenat je stavljen na individualizovanom preventivnom pristupu, a samim tim i na individualnoj proceni rizika za pojavu karijesa.

Cilj: ovog rada bio je da ukaže na značaj i mogućnosti procene rizika za nastanak karijesa u dečjem uzrastu.

Zaključak: Dalja istraživanja iz ove oblasti treba usmeriti na identifikaciji jedinstvenog faktora rizika za pojavu karijesa, odnosno kombinacije ovih faktora koji bi pokazali visok prediktivni značaj, i omogućiti veoma ranu identifikaciju pojedinca / populacione grupe u riziku pre kliničke manifestacije bolesti.

Ključne reči: procena karijes rizika, deca

Corresponding author:

Branislava Stojković, DDS,
Medicinski fakultet Niš,
Bulevar Dr Zoran Đinđić 81, Niš, Srbija
E-mail: sbranislava@gmail.com

Abstract

Introduction: as a process of determining the likelihood of developing a new carious lesion in a given person within a specific period of time and/or the likelihood of changes occurring in severity and/or activity within existing lesions. In the last decades, the emphasis has been put on personalized preventive approach that provides individual estimation of caries risk.

The aim: The aim of this study was to emphasize the significance and possibilities of caries risk assessment in children.

Conclusion: Further research in this field should be aimed at distinguishing unique caries risk factor or the combination of factors that would show high caries predictive importance, and to allow very early identification of an individual/population group at risk before a clinical manifestation of the disease

Key words: caries risk assessment, children

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za stomatologiju Niš. Sva prava zadržana.

Uvod

Karijes je najučestalije progresivno oboljenje tvrdih zubnih tkiva, kompleksne i multikauzalne etiologije. Epidemiološke studije pokazuju da je poslednjih godina prevalencija karijesa u porastu, i da se kod dece školskog uzrasta kreće u rasponu 60-90%^{1,2}, dok se prevalencija karijesa u ranom detinjstvu, u zavisnosti od uzrasta i ispitivane populacije, kreće u rasponu od 28 do 82%³. Rezultati istraživanja sprovedenog u Srbiji prema principima i metodologiji Svetske zdravstvene organizacije pokazuju da prevalencija karijesa kod trogodišnjaka u Srbiji iznosi 30,3%, kod dvanaestogodišnjaka 86%, a kod petnaestogodišnjaka 88,7%⁴. Istim istraživanjem je utvrđeno da svaki dvanaestogodišnjak u Srbiji u proseku ima 2,8, a svaki petnaestogodišnjak 5,56 stalnih zuba sa KEP-om.

Zbog visoke prevalencije i činjenice da u mnogim zemljama sveta karijes još uvek predstavlja veliki finansijski i javnozdravstveni problem¹, primarna prevencija ovog oboljenja predstavlja imperativ savremene stomatologije. U skladu sa tim, širom sveta se usvajaju i/ili revidiraju postojeći Nacionalni programi preventivne stomatološke zdravstvene zaštite stanovnika kojima se uređuju aktivnosti usmerene na očuvanje oralnog zdravlja stanovnika. U Republici Srbiji ovakav program je usvojen 2009. godine⁴, i njime je jasno istaknut značaj procene rizika za nastanak karijesa kao osnovnog preduslova efikasne prevencije ovog oboljenja.

Značaj procene rizika za nastanak karijesa

Procena rizika za nastanak karijesa predstavlja proces utvrđivanja verovatnoće da će se kod neke osobe tokom određenog vremena razviti nova karijesna lezija i/ili kao verovatnoća da će kod postojećih lezija doći do promene u težini i/ili aktivitetu⁵⁻⁷. Sprovodi se sa ciljem rane identifikacije pojedinca i/ili populacione grupe koja je u povećanom riziku, kako bi se preventivne i profilaktičke mere sprovele pre kliničke manifestacije bolesti.

Značaj procene rizika za nastanak karijesa najbolje ilustruju rezultati studije koju su 1993. godine sproveli Axelsson i saradnici⁸, koji su u jednoj oblasti Švedske konstantnim određivanjem rizika za pojavu karijesa, uz odgovarajuću primenu preventivno-profilaktičkih mera i postupaka, uspeli da za nekoliko godina KIP kod dece snize sa 6,5 na 1.

Introduction

Dental caries is most commonly a progressive disease of hard dental tissue of complex and multifactorial aetiology. Epidemiological studies show that prevalence of caries has been rising in recent years and that in school-aged children it ranges from 60-90%^{1,2}, while prevalence of early childhood caries, depending on age and population surveyed, ranges from 28 to 82%³. The results of the research conducted in Serbia, according to the principles and methodology of World Health Organization, show that prevalence of caries in three-year-olds in Serbia is 30.3%, in twelve-year-olds is 86%, and in fifteen-year-olds is 88.7%⁴. The same research has shown that every twelve-year-old in Serbia has an average of 2.8, and every fifteen-year-old has an average of 5.56 permanent teeth with DMF.

Due to high prevalence and the fact that caries still represents huge financial and public health problem¹ in many countries of the world, primary prevention of this disease is the imperative of modern dentistry. Accordingly, the existing National Programs of preventive dental health care for residents that regulate activities aimed at preserving the oral health of citizens are being adopted and/or revised around the world. The Republic of Serbia adopted this program in 2009⁴, which clearly emphasizes the importance of assessing the risk of developing caries as a basic precondition for effective prevention of this disease.

Importance of caries risk assessment

Caries risk assessment is a process of determining the likelihood of developing a new carious lesion in a given person within a specific period of time and/or the likelihood of changes occurring in severity and/or activity within existing lesions⁵⁻⁷. The aim of the assessment is early identification of an individual and/or a population group with increased risk in order to conduct preventive and prophylactic measures prior to clinical manifestation of the disease.

The significance of caries risk assessment is best illustrated by the results of a study conducted in 1993 by Axelsson and associates⁸. Constantly determining the risk of caries with appropriate application of preventive prophylactic measures and procedures in one area of Sweden, they managed

Efikasnost procene rizika za nastanak karijesa u prevenciji ovog oboljenja dokazana je i drugim studijama⁹.

Osim pomenutog, određivanje rizika za nastanak karijesa sa individualizovanom prevencijom predstavlja prvi korak u savremenom kliničkom pristupu karijesu, iza čega slede rana dijagnoza bolesti, minimalna invazivna sanacija i na kraju restauracija većih kaviteta i lečenje obolele pulpe¹⁰.

Utvrđivanje rizika za nastanak karijesa

Proces procene rizika za nastanak karijesa obuhvata identifikaciju faktora rizika za nastanak karijesa, ispitivanje njihovog uticaja na zdravlje zuba i predviđanje progresije/stabilizacije karijesnog procesa praćenjem incidencije i/ili promena u aktivitetu karijesnih lezija^{6,7,11}.

Kako je karijes multikauzalno oboljenje, kompleksne etiopatogenze, utvrđeno je da svi faktori koji su direktno ili indirektno uključeni u nastanak karijesa mogu biti od značaja u određivanju verovatnoće da će u budućnosti doći do njegove pojave, a koje su Fontana i sar.⁵ klasifikovali na kliničke (prethodno karijes iskustvo, gleđni defekti, otrodonske anomalije), biološke (genetski uticaj, sastav i osobine dentalnog biofilma, sastav i osobine pljuvačke), socioekonomske i demografske faktore (pol, rasa, etnička pripadnost, ekonomski standard pojedinca, obrazovni profil, uslovi života), sredinske (klima, izloženost fluoridima), bihevioralne faktore (temperament pojedinca, tip roditeljstva, higijensko-dijetetske navike) i faktore koji su vezani za roditelje/staraoce dece, a koji mogu biti od značaja za procenu karijes rizika kod dece (karijes roditelja/staraoce). Korišćenjem ovih varijabli u proceni rizika za nastanak karijesa može se utvrditi da li osoba pripada niskom, umerenom i visokom riziku za pojavu karijesa.

Istraživanja iz oblasti procene rizika za nastanak karijesa su usmerena na pronalaznje takvog karijes rizik biomarkera i takve metodologije, čija bi primena bila jednostavna, efikasna i ekonomična, a što bi istovremeno omogućilo preciznu i ranu identifikaciju visoko karijes-rizičnih pojedinca ili populacionih grupa pre kliničke manifestacije bolesti. U tom smislu, posebnu pažnju privukla je uloga pljuvačke, koja se zbog lake dostupnosti i činjenice da sadrži mikroorganizme i njihove produkte, sastojke hrane, ali i brojne odbrambene faktore, može koristiti kao medijum za praćenje sva tri primarna faktora u nastanku karijesa².

to lower the number of children with carious teeth from 6.5 to 1 in only a few years. The efficacy of caries risk assessment in the prevention of this disease has been proven in other studies as well⁹.

In addition to the aforementioned, determining the risk of caries development with personalized prevention represents the first step in modern clinical approach to caries, followed by early diagnosis of the disease, minimal invasive repair and finally, restoration of large cavities and treatment of diseased pulp¹⁰.

Determining the risks of developing caries

The process of caries risk assessment includes identification of caries risk factors, examination of their influence on health of teeth and prediction of progression/stabilization of the caries process by following incidence and/or changes in celiac lesion activity^{6,7,11}.

Since caries is multifactorial disease with complex etiopathogenesis, it has been determined that all the factors, directly or indirectly involved in the development of caries, can be important in determining the likelihood of its development in the future. The factors have been classified by Fontana and associates⁵ into: clinical (previous experience of caries, enamel defects, orthodontic anomalies), biological (genetic influence, composition and characteristics of dental biofilm, composition and characteristics of saliva), socioeconomic and demographic factors (gender, race, ethnicity, economic standard of an individual, educational profile, living conditions), environmental (climate, exposure to fluoride), behavioural factors (individual temperament, parenting type, hygienic-dietary habits) and factors regarding parents/guardians, which can be significant for caries risk assessment in children (caries in parents/legal guardians). Use of these variables in caries risk assessment can help us determine whether a person belongs to a low, moderate or high caries risk.

The research in the field of caries risk assessing is aimed towards finding such caries risk biomarker and such methodology that would have simple, efficient and economical application and that would, simultaneously, enable precise and early identification of individuals or population groups with high caries risk, prior to clinical manifestation of the disease.

Analiziran je veliki broj različitih salivarnih komponenti kao biomerakara zubnog kvara, koje su Gao i saradnici¹² podelili na: funkcionalne osobine pljuvačke (pH i protok pljuvačke), salivarne mikroorganizme (nivo *S. mutans* i *Lactobacillus* spp.), elektrolite i proteine. Posebna pažnja je usmerena na otkrivanje salivarnih komponenti koje bi pokazale visok prediktivni nivo karijesa i omogućile veoma ranu identifikaciju pojedinca koji je u riziku od nastanka ovog oboljenja. Uzimajući u obzir infektivnu etiologiju karijesa, sugerisano je da bi u proceni rizika za nastanak karijesa od velikog značaja mogle da budu i brojne antimikrobne komponente pljuvačke, ali su neophodne dobro dizajnirane longitudinalne studije koje bi ovo i potvrdile.

I pored ogromnog napretka učinjenog u ovoj oblasti karijesologije, do sada nije utvrđen nijedan faktor koji kao samostalni faktor ima visok prediktivni značaj. Zbog multikauzalne etiologije karijesa, ali i kompleksnosti etiopatogeneze ovog oboljenja, čiji tok umnogome može biti određen faktorima odbrane organizma, utvrđeno je da se stepen predvidljivosti povećava korišćenjem kombinacije većeg broja varijabli^{13,14}. Iako je istaknut veliki broj faktora značajnih u proceni rizika za nastanak karijesa, za sada se najznačajnijim smatraju prisustvo aktivnih karijesnih lezija, KEP/kep osobe, navike u ishrani, dnevna produkcija plaka, kvalitet i količine izlučene pljuvačke, puferski kapacitet pljuvačke, nivo *S. mutans* i nivo *Lactobacilla* u pljuvački, primena fluorida, opšte zdravstveno stanje pacijenata, stanje oralnog zdravlja roditelja/staraoca, kao i socio-ekonomskog statusa osobe. Međutim, istraživanja su pokazala da i među ovim faktorima postoji razlika u pogledu njihove prediktivne vrednosti, a da su najviši prediktivni nivo pokazali prethodno iskustvo sa karijesom, nivo *S. mutans* u pljuvački, unos fluorida i puferski kapacitet pljuvačke, dok to nije bio slučaj sa sastavom i ferikventnošću unosa hrane, nivoom *Lactobacillus* spp, količinom plaka i sekrecijom pljuvačke¹⁵. Osim toga, prediktivnu moć u proceni rizika za nastanak karijesa može imati i celokupni utisak koji pacijent ostavlja na stomatologa¹⁶.

Further, special attention was drawn to saliva which can, due to its availability and the fact that it contains microorganisms and their products, food content as well as numerous defence factors, be used as a monitoring medium for all three primary factors in caries development¹². A number of different salivary components have been analysed as biomarkers of dental decay, which Gao and associates¹² divided into: functional characteristics of saliva (pH and saliva flow), salivary microorganisms (level of *S. mutans* and *Lactobacillus* spp.), electrolytes and proteins. Special attention is paid to the detection of salivary components that would show high predictive level of caries and enable early identification of an individual who is at risk. Bearing in mind infectious aetiology of caries, it has been suggested that a number of antimicrobial components of saliva may be of great importance in the caries risk assessment, but well-designed longitudinal studies are necessary to confirm this.

In spite of enormous progress made in this field, not one factor has been singled out as a solo factor with high predictive significance. Due to multifactorial aetiology of caries, but also to complexity of etiopathogenesis of this disease, whose course can largely be determined by organism defence factors, it has been determined that the degree of predictability is increased by using the combination of a large number of variables^{13,14}. Although a number of factors is significant for caries risk assessment, currently, the most important are presence of active caries lesions, DMF people, nutrition habits, daily production of plaque, quantity and quality of saliva, buffer capacity of saliva, level of *S. mutans* and level of *Lactobacillus* in saliva, application of fluoride, general health condition of the patient, oral health condition of the parent/legal guardian, as well as socio-economic status of the person. However, research has shown that these factors differ regarding their caries predictive value and that the highest predictive level is seen in previous caries experience, level of *S. mutans* in saliva, intake of fluoride and buffer capacity of saliva. This was not the case with the content and frequency of food intake, level of *Lactobacillus*, quantity of plaque and saliva secretion¹⁵. In addition, overall impression that a patient leaves on a dentist can have predictive power in assessing the risk of caries development¹⁶.

Poslednjih decenija akcentat je stavljen na individualizovani preventivni pristup, a samim tim i na individualnu procenu rizika za pojavu karijesa. To je proizašlo iz masovne primene fluorida, čime je često maskirana uloga pojedinih faktora u procesu procene rizika za nastanak karijesa, ali i činjenice da značaj mnogih u velikoj meri zavisi i od uzrasta pacijenta.

Specifičnosti procene rizika za nastanak karijesa u dečjem uzrastu

Procena rizika za nastanak karijesa treba da bude neizostavni deo procene celokupnog zdravlja, i treba je izvršiti u toku prve godine života, pre ili u vreme nicanja prvih mlečnih zuba, a zatim je periodično ponavljati⁵. U skladu sa time, Zakonom o zdravstvenom osiguranju Republike Srbije regulisano je da procenu rizika za nastanak karijesa treba obaviti u toku prve godine života, a zatim je kontinuirano ponavljati na godinu dana.

Kod odojčadi i male dece prethodna pojava karijesa, iako ima visok prediktivni nivo, nije od velikog od značaja u proceni rizika za pojavu karijesa, budući da je osnovni cilj utvrditi rizik pre kliničke manifestacije bolesti. Osim toga, smatra se da salivarni faktori (pH pljuvačke, protok pljuvačke) nisu od velike pomoći, kao ni frekventnost unosa ugljenih hidrata, što autori objašnjavaju unosom fluorida, koji, pre svega, imaju preventivni značaj. Istraživanjima je utvrđeno da su u ovom uzrastu najviši karijes prediktivni značaj pokazali produženi noćni obroci bočicom, akumulacija dentalnog biofilma na zubima, izbegavanje primene fluorida, nizak socio-ekonomski standard porodice, kao i loše stanje zdravlja zuba majke/starooca. Iako mnogi faktori kod odojčadi i male dece nisu pokazali visok prediktivno nivo, nikako se ne smeju zanemariti u praksi pri proceni rizika za nastanak karijesa.

Kod dece predškolskog uzrasta je utvrđeno da je sa pojavom karijesa snažno povezana akumulacija dentalnog biofilma i nivo *S. mutans* u pljuvački^{17,18}. Pojava jednog ili većeg broja zuba sa karijesom u ovom uzrastu je znak značajnog rizika za razvoj novih lezija i zahteva hitnu i sveobuhvatnu intervenciju. Istraživanja pokazuju da su značajni karijes prediktori u ovom uzrastu obrazovanje i stavovi roditelja¹⁹. Navike u ishrani su takodje od značaja, ali je njihov prediktivni nivo nešto manji od pomenutih faktora, i maskiran upotrebom

In the last decades, the emphasis has been put on a personalized preventive approach that provides individual estimation of caries risk. This resulted from the massive use of fluoride that often masks the role of some factors in the process of caries risk assessment, but also from the fact that the importance of many risk factors, apart from race, ethnicity and cultural habits, largely depends on patient's age.

Specificities of caries risk assessment in children's age

Caries risk assessment should be inevitable part of the overall health assessment and should be conducted within the first year of life, prior to or during teething and should also be repeated periodically⁵. Accordingly, the Law on Health insurance of Republic of Serbia specifies that the risk assessment should be conducted within the first year of life and that should be continually, annually repeated.

Even though it has high predictive level, prior caries experience is not so much important for caries risk assessment in infants and young children, because the main goal is to determine the risk prior to clinical manifestation of the disease. Additionally, salivary factors (pH of the saliva, saliva flow) are not considered as great help, nor is the frequency of carbohydrates intake. Authors explain this by fluoride intake, which, above all, has significance in caries prevention. The research has confirmed that prolonged night meals on a bottle, accumulation of dental biofilm on teeth, avoidance of fluoride intake, and low socioeconomic standard of the family as well as poor health of teeth in mother/legal guardian had the most caries predictive influence in this age. Although many factors have not shown high predictive level in infants and toddlers, they should not be neglected in practice when assessing the risk of caries development.

Regarding preschoolers, it has been determined that developing caries is closely connected with accumulation of dental biofilm and level of *S. mutans* in saliva^{17,18}. Developing caries on one or more teeth in this age is a sign of significant risk for the development of new lesions and demands urgent and comprehensive intervention. The research has also shown that parents' education and attitudes play significant role in predicting caries¹⁹.

fluorida. Smatra se da u ovom uzrastu najbolji model za procenu rizika za pojavu karijesa treba da obuhvati socio-ekonomski status porodice, socio-demografske karakteristike i prethodnu iskustvu karijesa¹⁹. I kod dece školskog uzrasta i adolescenata utvrđeno je da je najbolji samostalni prediktor prethodna pojava karijesa, dok je uloga salivarne koncentracije *S. mutans*, upotrebe ugljenih hidrata manje precizna nego kod dece predškolskog uzrasta. Puferski kapacitet pljuvačke u ovom uzrastu ne doprinosi predikciji karijesa¹⁹. Međutim, pojedine studije su istakle značaj morfologije zuba, kao faktora rizika za nastanak karijesa, s obzirom da su prvih nekoliko godina nakon erupcije zuba period visokog rizika za nastanak karijesa, o čemu treba voditi računa.

Modeli za procenu rizika za nastanak karijesa

Iako je pri rutinskom stomatološkom pregledu, intervjuisanjem roditelja i kliničkim pregledom moguće dobiti podatke za sasvim korektnu procenu rizika za nastanak karijesa kod dece, javila se potreba za kreiranjem papirnih formi, modela i kompjuterskih programa koji bi kliničarima olakšali procenu rizika za nastanak karijesa u svakodnevnoj praksi. Ova potreba proizašla je iz činjenica da je rizik za nastanak karijesa podložan promenama tokom vremena, i da se registrovanjem podataka omogućava praćenje njihovog uticaja u nastanku karijesa svake individue tokom dužeg vremenskog perioda. Osim toga, sve to bi istovremeno imalo i motivacionu ulogu na pacijenta i značajno doprinelo prevenciji karijesa. Polazeći od svega navedenog, ali i već istaknutih činjenica da nijedan faktor kao samostalni ne pokazuje visok prediktivni nivo, da se stepen predvidljivosti povećava korišćenjem kombinacije većeg broja varijabli, i da značaj mnogih faktora u proceni rizika za pojavu karijesa zavisi od uzrasta, odnosno starosti pacijenta, ekspertske grupe su kreirale gotove modele za procenu rizika za nastanak karijesa, čija je efikasnost testirana za različite starosne i populacione grupe.

Američka akademija dečjih stomatologa (AAPD) je 2002. godine usvojila i periodično revidirala modele za procenu rizika za nastanak karijesa, posebno za decu do tri godine starosti, za decu do 6 i starije od 6 godina²⁰ (Slika 1).

Eating habits are also important, but their predictive level is slightly lower and it is masked by the use of fluoride. It is believed that the best model for assessing caries risk in this age should include socioeconomic status of the family, sociodemographic characteristics and previous caries experience¹⁹. It has also been determined that the best solo predictor in school children and adolescents is previous caries experience while the role of salivary concentration of *S. mutans* and use of carbohydrates is less accurate than in preschoolers. The buffer capacity of saliva in this age does not contribute to caries prediction¹⁹. However, some studies have emphasized the significance of teeth morphology as a risk factor for developing caries since the first few years after teething are the period of high risk for developing caries, which people should pay attention to.

Models for assessing the risk of developing caries

Although the routine dental examination, which includes interviewing the parents and clinical examination, provides data for appropriate caries risk assessment, there is still the need for creation of paper forms, models and computer programs that would alleviate caries risk assessment in everyday practice. This need has arose from the fact that the risk of caries development is susceptible to changes over time, and registering the data would enable monitoring their influence in caries development in every person over a longer period of time. Besides, it would simultaneously have a motivational role in a patient and would significantly contribute to prevention of caries. Taking everything into account, together with the fact that none of the factors show high predictive level as solo factor, that the level of predictability rises with the use of combination of larger number of variables and that the importance of many factors in caries risk assessment depends on patient's age, expert groups have created ready models for caries risk assessment, whose efficiency is tested on different age and population groups.

In 2002, American Academy of Paediatric Dentistry (AAPD) adopted and periodically revised models for assessing the

Factors	High Risk	Moderate Risk	Protective
Biological			
Mother/primary caregiver has active cavities	Yes		
Parent/caregiver has low socioeconomic status	Yes		
Child has >3 between meal sugar-containing snacks or beverages per day	Yes		
Child is put to bed with a bottle containing natural or added sugar	Yes		
Child has special health care needs		Yes	
Child is a recent immigrant		Yes	
Protective			
Child receives optimally-fluoridated drinking water or fluoride supplements			Yes
Child has teeth brushed daily with fluoridated toothpaste			Yes
Child receives topical fluoride from health professional			Yes
Child has dental home/regular dental care			Yes
Clinical Findings			
Child has white spot lesions or enamel defects	Yes		
Child has visible cavities or fillings	Yes		
Child has plaque on teeth		Yes	

Circling those conditions that apply to a specific patient helps the health care worker and parent understand the factors that contribute to or protect from caries. Risk assessment categorization of low, moderate, or high is based on preponderance of factors for the individual. However clinical judgment may justify the use of one factor (e.g., frequent exposure to sugar containing snacks or beverages, visible caries) in determining overall risk.

Overall assessment of the child's dental caries risk: High Moderate Low

Slika 1. Forma Američke akademije za dečju stomatologiju za procenu rizika za nastanak karijesa kod dece uzrasta 0-5 godina²⁰

Figure 1. American Academy of Pediatric Dentistry form for caries risk assessment for children aged 0-5 years²⁰

Ovim modelima pridodati su sledeći faktori: sadašnje i prošlo iskustvo u pojavi karijesa, upotreba fluorida, ishrana, salivarni status, opšte zdravstveno stanje, socio-ekonomski status, medicinske i druge faktore. Ova asocijacija je istovremno uz modele za procenu krijes rizika dala i kliničku preporuku za upravljanje karijesom na osnovu utvrđenog rizika za datu starosnu grupu, što predstavlja veliku prednost korišćenja ovog modela.

Slično predhodnoj asocijaciji, Američko udruženje stomatologa je kreiralo formulare za procenu rizika za nastanak karijesa, za uzrast od 0 do 6 godina, i uzrast preko 6 godina^{21,22} (Slika 2).

risk of caries development, especially for 3-year-olds, 6-year-olds and children over six years of age²⁰ (Figure 1). These models include following factors: current and previous caries experience, use of fluoride, nutrition, salivary status, general health condition, socio-economic status, medical and other factors. Together with caries risk assessment models, this association provided clinical recommendation for managing caries based on determined risk for given age group, which presents huge advantage of using this model²⁰.

Similar to previous association, American association of dentists has created forms for caries risk assessment for the age from 0 to 6 years and the age of over six years^{21,22} (Figure 2).

a Caries Risk Assessment Form (Ages 0-6)				
Patient Name:		Score:		
Birth Date:		Date:		
Age:		Initials:		
	Low Risk (0)	Moderate Risk (1)	High Risk (10)	Patient Risk
Contributing Conditions				
I. Fluoride Exposure (through drinking water, supplements, professional applications, toothpaste)	Yes	No		
II. Sugary or Starchy Foods or Drinks (including juice, carbonated or non-carbonated soft drinks, energy drinks, medicinal syrups)	Primarily at mealtimes	Frequent or prolonged between meal exposures/day	Bottle or sippy cup with anything other than water at bed time	
III. Eligible for Government Programs (WIC, Head Start, Medicaid or SCHIP)	No		Yes	
IV. Caries Experience of Mother, Caregiver and/or Other Siblings	No carious lesions in last 24 months	Carious lesions in last 7-23 months	Carious lesions in last 6 months	
V. Dental Home: established patient of record in a dental office	Yes	No		
General Health Conditions				
I. Special Health Care Needs*	No		Yes	
Clinical Conditions				
I. Visual or Radiographically Evident Restorations/Cavitated Carious Lesions	No carious lesions or restorations in last 24 months		Carious lesions or restorations in last 24 months	
II. Non-cavitated (incipient) Carious Lesions	No new lesions in last 24 months		New lesions in last 24 months	
III. Teeth Missing Due to Caries	No	Yes	Yes	
IV. Visible Plaque	No	Yes		
V. Dental /Orthodontic Appliances Present (fixed or removable)	No	Yes		
VI. Salivary Flow	Visually adequate		Visually inadequate	
TOTAL:				

Instructions for Caregiver:

*Patients with developmental, physical, medical or mental disabilities that prevent or limit performance of adequate oral health care by themselves or caregivers.

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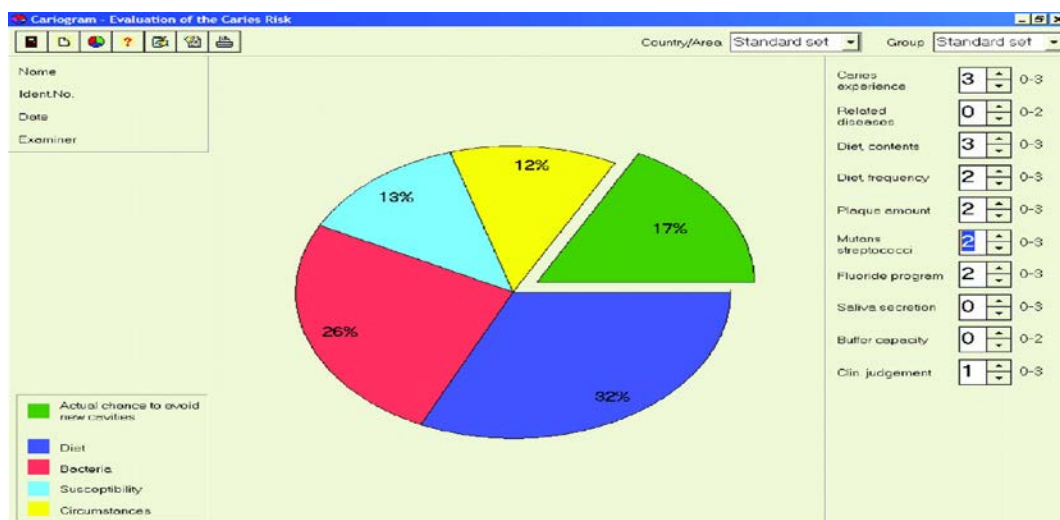
ADA American Dental Association®

Slika 2. Forma Američke dentalne akademije za procenu rizika za nastanak karijesa kod dece uzrasta 0-6 godina²¹

Figure 2. American Dental Association form for caries risk assessment for children aged 0-6 years²¹

Bratthall i saradnici²³ su 1997. godine razvili Cariogram, kompjuterski program za procenu rizika za nastanak karijesa (Slika 3). Program uzima u obzir interakciju između individualno procenjenih faktora rizika za pojavu karijesa, a sastoji se iz pet sektora. Prva četiri čine: “ishrana”, koja predstavlja kombinaciju sastava i frekventnosti unosa hrane, “bakterije” koje predstavljaju kombinaciju količine plaka i količine S.mutansa u pljuvački, “osetljivost”-kombinacija programa fluorida, količine i puferskog kapaciteta pljuvačke i “okolnost” koja predstavlja kombinaciju prethodnog iskustva sa karijesom i sistemskih bolesti.

In 1997, Bratthall and associates²³ developed Cariogram - computer program for caries risk assessment (Figure 3). Program considers the interaction between individually assessed caries risk factors and is composed of five sectors. The first four are: “nutrition”, which presents combination of content and frequency of food intake, “bacteria” which presents combination of plaque and the quantity of S.mutans in saliva, “sensitivity”-combination of fluoride program, quantity and buffer capacity of saliva and “circumstance” which presents combination of previous caries experience and systemic diseases.



Slika 3. CARIOGRAM- Kompjuterski program za procenu rizika za nastanak karijesa²³

Figure 3. CARIOGRAM-Computer program for caries risk assessment²³

Peti sektor je označen kao “šansa da se u bliskoj budućnosti izbegne karijes”. Ovaj kompjuterski program, zapravo, pokazuje u kojoj meri različiti faktori utiču na šansu da dođe do pojave nove karijesne lezije. Program je kreiran sa ciljem da da grafičku demonstraciju rizika za pojavu karijesa, za datog pacijenta, iskazanu kao “šansa da se izbegne novi karijes” u bliskoj budućnosti. Smatra se da je primena ovog programa u proceni rizika za nastanak karijesa efikasnija kod dece školskog u odnosu na decu predškolskog uzrasta^{24,25}.

Vulović i saradnici²⁶ su predložili da se u oblasti dijagnostike rizika za nastanak karijesa dece našeg podneblja koriste provereni parametri, kao što su test kvaliteta i načina ishrane, test nivoa dnevne produkcije plaka, test kvaliteta i količine izlučene pljuvačke, test puferskog kapaciteta pljuvačke, određivanje nivoa S. mutansa u pljuvački, određivanje

The fifth sector is marked as “the chance to avoid caries in the near future”. This computer program actually shows to what extent various factors influence the chance of developing new caries lesion. The aim of the program is to provide graphic demonstration of caries risk for a given patient, shown as “the chance to avoid new caries” in the near future. It is believed that the use of this program in assessing the risk of caries development is more efficient in school children compared to preschoolers^{24,25}.

Vulović and associates²⁶ have suggested the use of proven parameters in the field of diagnosing the risk of developing caries in children in our area. They include tests of nutrition and nutrition quality, level of daily plaque production test, test of quality and quantity of saliva, test of buffer capacity of saliva, determining the level of S. mutans in saliva, determining the level of

saliva, in DMF person. nivoa laktobacila u pljuvački, KEP/kep osobe. Međutim, i pored ove preporuke, procena rizika se u svakodnevnom radu najčešće vrši na osnovu podataka dobijenih od roditelja o navikama u ishrani, održavanju oralne higijene, primeni fluorida, kao i kliničkom pregledu deteta, budući da su pojedini testovi, kao što su testovi određivanje nivoa *S. mutans* i *Lactobacilla* u pljuvački, za naše uslove skupi i za većinu pacijenata ekonomski nedostupni. U našoj zemlji za sada ne postoji vodič za procenu rizika za nastanak karijesa, iako je prevalencija karijesa u dečjem uzrastu u Republici Srbiji visoka.

Zaključak

Budući da procena rizika za nastanak karijesa predstavlja osnovni preduslov efikasne primarne prevencije karijesa, ali i prvi korak u savremenom kliničkom pristupu karijesa, neophodno je njeno kontinuirano sprovođenje od prve godine života, i na dalje, tokom čitavog detinjstva i života osobe. Identifikovan je veliki broj faktora rizika za pojavu karijesa i kreiran veliki broj modela-vodiča koji olakšavaju kliničarima procenu rizika za nastanak karijesa u svakodnevnoj praksi uz monitoring uticaja pojedinih faktora za svakog pacijenta ponaosob, što omogućava adekvatnu, individualnu primenu preventivno-profilaktičkih mera. Dalja istraživanja iz ove oblasti treba usmeriti na pronalaženje jedinstvenog faktora rizika za pojavu karijesa, odnosno kombinacije ovih faktora koji bi pokazali visok prediktivni značaj, počevši od najranijeg detinjstva, pa na dalje, a u cilju primarne prevencije ovog vodećeg oralnog oboljenja u dečjem uzrastu.

Lactobacilli in saliva, in DMF person. However, apart from this suggestion, everyday risk assessment is mostly based on data provided by parents regarding nutrition habits, oral hygiene, fluoride application as well as clinical examination. This is because the tests, as the test of determining the level of *S. mutans* and *Lactobacilli* in saliva, are very expensive for our conditions and are financially unavailable for most patients. Our country does not have a guide for assessing the risk of caries development even though the caries prevalence in child's age is high in Republic of Serbia.

Conclusion

Since caries risk assessment is basic precondition for efficient primary prevention of caries, but also the first step in modern clinical approach to caries, its continuous implementation from the first year of life is necessary as further implementation through childhood and life. A number of caries risk factors have been identified and a number of models-guides have been created in order to ease the risk assessment of caries development in everyday practice together with monitoring the influence of some factors for each patient individually, which enables adequate, individual application of preventive-prophylactic measures. Further research in this field should be aimed at distinguishing unique caries risk factor or the combination of factors that would show high caries predictive importance from the earliest childhood on, with the goal of primary prevention of this, leading oral disease in children.

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Financial support and sponsorship

None

Conflict of interest

There is no conflict of interest

Patient consent

All involved patients gave their consent forms

Ethics approval

This study is in accordance with the Helsinki Declaration