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Klinički i tribološki pogled na trošenje zuba

Clinical and Tribological View on Tooth Wear

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Sažetak

U radu su opisane različite interpretacije trošenja zuba, njihove kliničke manifestacije te etiopatogenetski modeli nastanka. Tribološki mehanizmi objašnjavaju proces trošenja zubnih površina na ultrastrukturnoj razini, a klinički se klasificiraju kao atricija, abrazija, erozija i abfrakcija. Složena etiologija te sinergistički učinci različitih mehanizama trošenja, uz njihovo sinkrono duže djelovanje, uvjetuju da se teško klinički razlikuju pojedini procesi trošenja tvrdih zubnih tkiva. Za klinički je uspjeh važno pravodobno dijagnosticirati mehanizam koji je prouzročio gubitak zubnoga tkiva radi predvidivosti daljnjih zbivanja s obzirom na to koji su zahvati planirani tijekom oralne rehabilitacije.

Zaprimljen: 23. veljače 2007.

Prihvaćen: 11. lipnja 2007.

Adresa za dopisivanje

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Ključne riječi

trošenje zuba; zub, abrazija; zub, atricija;
zub, erozija

Uvod

Gubitak i prekomjerno trošenje tvrdih zubnih tkiva trajan je problem suvremenog čovjeka u gotovo svim dobnim skupinama. Proces se događa kontinuirano i polako tijekom života i sastavni je dio procesa starenja. Kod nekih je ljudi trošenje jače izraženo te može uzrokovati oštećenja oblika, funkcije i vitalnosti zuba. Fizikalno-mehanička i kemijska djelovanja koja uzrokuju gubitak fiziološke i habitualne morfologije zubnih ploha i njihova pojavnost te značenje, danas su drugačija nego prije (1,2). U paleontološkim nalazima pračovjeka, primjerice, očit je izrazit gubitak tvrdih zubnih tkiva, što se tumači njihovim prehrambenim navikama, ponašanjem i načinom života (3-5).

Kod prekomjernog trošenja zubi važno je to što njihova etiologija, kliničko očitovanje i učinak

Introduction

Loss and excessive wear of hard dental tissues is a permanent problem of the dentition, especially in modern man, encompassing almost all age groups. Tooth wear is an inherent part of the aging process which means that it occurs continuously but slowly throughout life. In some individuals tooth wear can be manifested to a greater extent thus leading to severe morphological, functional and vital damages to the teeth which cannot be considered normal. Physical-mechanical and chemical effects can have an impact on the loss of physiological and habitual tooth surface morphology although their occurrence and importance has changed over time (1, 2). The paleontological findings of the prehistoric man showed a considerable loss of hard dental tissues which can be explained by his dietary habits, behaviour and living culture (3-5).

određuju sve restauracijske stomatološke postupke. (6-8). Osnovni su oblici gubitka tvrdih zubih tkiva abrazija, atricija i erozija. Tijekom prvog posjeta stomatolog ne može pacijentu ustvrditi pravi uzrok i tijekom nastanka trošenja zuba, te uočenu pojavu naziva „trošenje zuba“. Ponekad je teško razlikovati atriciju i abraziju, jer njihovi su klinički znakovi slični, to jest mogu imati međusobno sinergistički patološki učinak. Abrazija je trošenje zuba zbog neke nefiziološke stvari u ustima, na primjer protetskog rada, ili je, pak, mogu uvjetovati loše navike te profesionalni razlozi i abrazijsko sredstvo u ustima. Atricija je isključivo trošenje zubnih tkiva tijekom normalne funkcije i parafunkcije (bruksizma) žvačnoga sustava, bez utjecaja abrazivnoga sredstva. Djelovanje kemijskih ili elektrolitskih procesa u ustima završava destrukcijom tvrdih zubnih tkiva, što nazivamo erozijom (9-11).

U kliničkom radu čest su problem diferencijalno-dijagnostičke procjene moguće važnosti jednoga ili više spomenutih procesa trošenja zuba. S obzirom na to da je trošenje zuba očekivani fiziološki proces, teško je procijeniti stanje i koji je od tih procesa znatnije pridonio patološkom trošenju zuba (12,13).

Trošenje je progresivni gubitak materijala s radnih površina tijela zbog dinamičkog kontakta s drugim tijelom ili fluidom. Tribologija je interdisciplinarna znanost o trenju, trošenju i podmazivanju. Ona razlikuje pojedine mehanizme trošenja zubnih tkiva u ustima na ultrastrukturnoj razini. Na makroskopskoj razini promatranja uzročnika prekomjernog trošenja zuba, razlikuju se loša oralna navika i ijetrogeni uzročnik (14,15).

Svrha rada je opisati različite oblike trošenja zuba s obzirom na njihove kliničke manifestacije i etiopatogenetske modele nastanka te njihovu važnost za rekonstrukcijske stomatološke zahvate.

Tribološki mehanizmi trošenja zubnih površina

Trošenje zubnih površina bez posredstva stranog medija zbog mikroskopski predočive nesavršenosti

The etiology, manifestation and effect of excessive tooth surface loss have a great significance for all restorative dental sciences. Teeth can successfully compensate for the loss of their tissues by migration and elongation which would not disturb the basic functions of the masticatory system (mastication, speech and physiognomy) (6-8).

Basic dental divisions of hard dental tissue loss are: abrasion, attrition and erosion. Upon first dental visit the dentist usually cannot find the real cause of tooth wear as well as its course of development. Therefore a general term "tooth wear" is recommended. Sometimes it is difficult to distinguish attrition from abrasion because they have similar clinical signs, which means that they can have mutual synergistic pathological effect. Abrasion includes tooth wear due to some non-physiological, hard material in the mouth such as a prosthodontic appliance, it also includes abrasion in people with inappropriate habits or it can be caused by professional reasons due to presence of an abrasive in the mouth. Attrition is exclusively wear of dental tissues during routine function and parafunction (bruxism) of masticatory system without an abrasive. Chemical or electrolytic processes in the mouth result in destruction of hard dental tissues which is called erosion (9-11).

Although this established classification of tooth wear is logical, differential diagnostic assessment of the potential importance of one or more above mentioned processes of tooth wear may become a great problem in clinical practice. Since tooth wear is an expected physiological process of each individual, it is difficult to assess a condition which can be considered pathological and/or which of the mentioned processes significantly contributed to pathological tooth wear (12, 13).

Tribology (a discipline which studies the mutual friction, wear and lubrication of materials) does not recognize "attrition" in its own right; instead it recognizes certain mechanism of dental tissues wear in the mouth at the ultrastructural level. At the macroscopic level there is a possibility of tooth wear due to inappropriate habit and iatrogenic causes (14, 15).

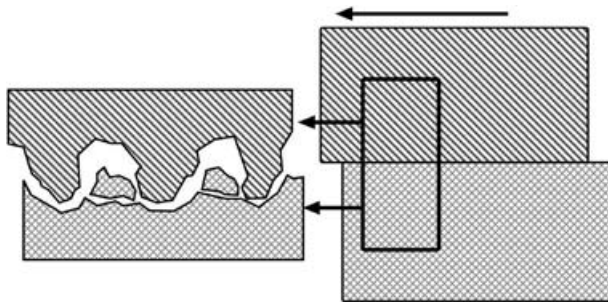
The aim of this paper was to give an overview of different interpretations of tooth wear, its clinical manifestations and etiopathogenic models, different dental classifications and their importance to restorative dental sciences.

Tribological Mechanisms of Tooth Surface Wear

Tooth surface wear without mediators develops because of tooth imperfections. Since there are al-

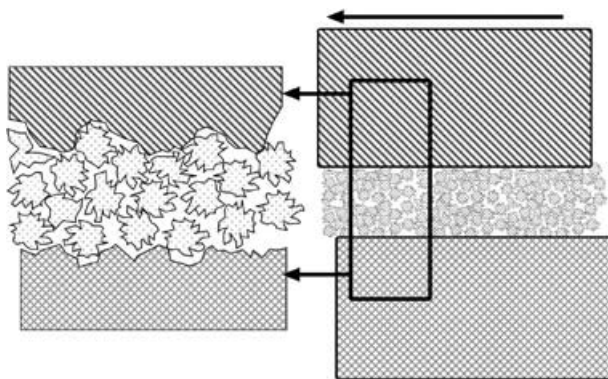
zubnih ploha (Slika 1.). Najčešći je klinički oblik trošenja zuba kod ekscurzivskih kretnji brusna faseta. Zbog trošenja vrhova očnjaka tijekom okluzije vođene očnjacima, nastaju dodatni laterotruzijski (radni) i/ili mediotruzijski (ravnotežni i hiperbalansirni) dodiri (Slika 2.) (15).

Trošenje zubnih površina uz prisutnost posrednika, tj. abrazijskog sredstva među antagonističkim zubnim ploham, događa se tijekom kretnji mandibule. Učinak ovisi o veličini abrazijskih čestica, njihovoj količini i tvrdoći te o tvrdoći zubnih površina. Takva vrsta trošenja zuba najčešće nastaje žvakanjem hrane različite tvrdoće (14-16).



Slika 1. Zubne površine nisu idealno ravne, pa klizne kretnje uzrokuju lomljenje nastalih neravnina i trošenje zubne površine, što je izraženo kada je površina jednog zuba mekša od antagonističkog zuba

Figure 1 Teeth surfaces are not ideally smooth so that sliding movements cause cracking of the formed uneven surfaces and tooth wear which is prominent when the surface of a tooth is softer than its antagonist.



Slika 3. Tijekom početne faze abrazijskog trošenja zuba abrazivne čestice pod žvačnim tlakom stvaraju inicijalna oštećenja zubnih ploha. Trošenje je izraženije ako je jedna površina mekša od površine antagonističkog zuba.

Figure 3 In the course of the initial phase of tooth wear the abrasive particles under masticatory pressure cause initial damage to dental surfaces. Wear is more prominent if the surface of one tooth is softer than the antagonist surface.

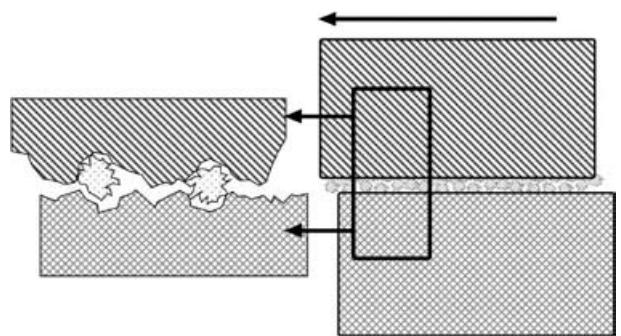
ways certain asperities on occlusal surfaces, mutual tooth wear occurs upon contact between antagonists (Figure 1). The most common clinical pattern of tooth wear is polished facet in excursion movements. The formation of additional laterotrusional (working-side) and/or mediotrusional (balancing and hyperbalancing) contacts (Figure 2) (15).

Tooth surface wear with mediators is tooth wear due to presence of abrasive between the antagonist surfaces during mandibular movements. The effect of abrasive particles will depend on their size, amount and hardness as well as on hardness of tooth surfaces. Such a pattern of tooth wear occurs due to mastication of food of different hardness (14-16).



Slika 2. Brusne fasete na očnjacima laterotruzijske strane kod 25-godišnje žene

Figure 2 Polished facets on canines, in a 25-year-old female, on a laterotrusive side.



Slika 4. Tijekom kasnije faze abrazijskog trošenja veće čestice, u već formiranim neravninama zubnih ploha, stvarati daljnja oštećenja zubnih površina

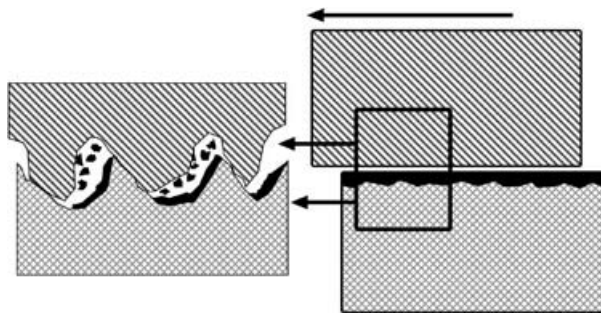
Figure 4 In a later phase of abrasive tooth wear greater particles will cause further damage into already formed uneven surfaces.

Ipak, razlikuju se pojedine faze abrazivskog trošenja zuba. Početna oštećenja zbog djelovanja abrazivskih čestica hrane očituju se u jedva zamjetljivim neravninama na zubnim ploham (Slika 3.). Daljnjim napredovanjem produbljuju se već nastale hrpavosti zubnih ploha (Slika 4). Više će se trošiti manje tvrda zubna ploha. Taj oblik trošenja jasno se klinički može identificirati, jer istrošene zubne plohe nisu nikada u dodiru tijekom ekskurzijskih kretanja. Učinak mastikacijskoga trošenja ovisit će o vrsti prehrane, to jest o grubosti sastojaka živežnih namirnica. Klinički uvijek moraju biti istrošene antagonističke okluzijske plohe i/ili incizalni bridovi zuba, jer ako je antagonistička strana intaktna, tada je u pitanju erozijsko trošenje.

Korozivsko trošenje ili erozija je nekarijesno trošenje zubnih ploha zbog djelovanja kiselog medija u ustima. Tijek se objašnjava pomicanjem oštećenih čestica zubne površine koje izlažu intaktne dijelove

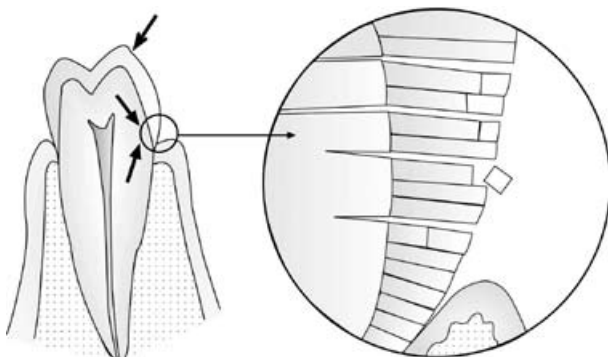
Nevertheless, abrasive tooth wear occurs in stages. Relatively intact antagonist surfaces are damaged by abrasive particles from the masticated food which cause surface asperities (Figure 3). Further progression of wear results from already formed ruggedness and surface asperities which lead to progression of abrasive process (Figure 4). There will be more excessive tooth wear on surfaces of lesser hardness. This pattern of wear can be clearly clinically identified since worn surfaces never come in contact during excursive movements. The shape of masticatory surface of the teeth will depend on the diet and on the food type. Clinically, antagonist occlusal planes and/or incisal edges always have to be worn, because if there is a situation wherein the antagonist side is intact, the erosive pattern of tooth wear is in question.

Corrosive wear or erosion is non-cariouse wear of tooth surfaces caused by acid medium in the mouth. Erosion is explained by rubbing away of damaged



Slika 5. Erozijsko ili korozivsko trošenje događa se na površinama izloženima korozivnom sredstvu, a nisu u okluzivskom dodiru. Međusobni dodiri zubnih ploha dovode do lakšeg trošenja ploha već oštećenih korozijom. Korozivsko će sredstvo djelovati na dublje slojeve zuba koji su zbog trošenja postali površinski.

Figure 5 Erosion or corrosive wear occurs on the surfaces exposed to a corrosive which are not in occluding contact. Mutual contact of tooth surfaces leads to mild wear of surfaces previously damaged by corrosion. A corrosive will affect deeper layers of teeth which have become surface layers due to wear.



Slika 6. Shematski prikaz abfrakcije – lomljenje caklinskih prizama uzrokovano stresnim učinkom okluzivskog opterećenja koje se koncentriira na dijelu uz rubove kruna

Figure 6 Schematic view of abfraction – enamel prism fracturing due to stress effect of occlusal load which is focused on the area along the marginal edges of the crowns.



Slika 7. Abfrakcija zubi kod 78-godišnjeg pacijenta
Figure 7 Tooth abfraction in a 78-year-old male patient.

zuba daljnjim djelovanjem erozijskoga sredstva, što završava širenjem erozijom oštećene cakline, najčešće na vratnom dijelu vestibularnih ploha te okluzijskim ploham zuba (Slika 5.) (16-18).

Abfrakcija (stresna lezija) su lomovi dijelova zubnih kruna, a uvjetovana je stresnim učinkom okluzijskoga opterećenja funkcijske ili parafunkcijske sile koja se koncentrira na dijelu uz rubove kruna. Abfrakcija se objašnjava međudjelovanjem okluzijskih sila koje stvaraju fleksiju zuba u aksijalnom i paraaksijalnom smjeru. Oštećenja su češća kod bruxizma i nisu karijesne etiologije. Destruktivno djelovanje na zube bit će pojačano erozijskim i abrazijskim djelovanjem. (Slike 6. i 7.) (19-22).

Etiopatogeneza

Trošenje zuba nije samo tribološki gledano kompleksna patološka promjena nekarijesnog podrijetla. U znanstvenoj literaturi postoje razlike u važnosti pojedinih kliničkih osobitosti trošenja koje uzrokuju trošenje zuba. U Sjevernoj Americi češće se spominje atricija, a u Europi erozija. Ipak postoji jedinstven model prema kojem se objašnjava etiopatogeneza trošenja zuba kao multifaktorijalna pojava (23). Mogući su sljedeći čimbenici:

Zdravstveno stanje i bolesti probavnoga sustava

Premda opće zdravstveno stanje nije izravan etiopatogenetski čimbenik trošenja zuba, kod psihičkih bolesnika, primjerice, uočeno je trošenje zuba, što se objašnjava češćim oralnim parafunkcijama (24). Djeca s posebnim potrebama (na primjer Downovim sindromom) pokazuju znatno više znakova trošenja zuba zbog atricije i erozije (25). Erozijski zuba uzrokuju bolesti probavnog sustava koje dovode do gastrofagealnoga refluksa želučanoga soka (na primjer bulimija nervosa), jer oralni medij postaje sve kiseliji, što uzrokuje nekarijesnu demineralizaciju cakline. Endogeno uzrokovana erozija može biti posljedica patološki promijenjene funkcije slinovnica i sastava sline (26-28).

Sredstva i način provedbe oralne higijene

Trošenje zuba tijekom provedbe zubne higijene zubnom četkicom ovisit će o njezinoj tvrdoći, sastojcima zubne paste i osobito o tehnici četkanja zuba. Dugotrajno četkanje u vodoravnom smjeru uzrokovat će uzure na vestibularnim ploham zuba (29-31).

surface molecules leaving fresh surfaces to further exposure to erosive agents, which leads to widening of enamel damaged by erosion, most commonly on the cervical part of vestibular surfaces as well as on the occlusal planes (Figure 5) (16-18).

Abfraction implies fractures of parts of dental crowns caused by occlusal loads of functional and parafunctional force producing stress concentrations around the cervical margin of the crown. Abfraction occurs due to mutual action of occlusal forces which produce the flexion of the teeth both axially and para-axially. The destructive effect on teeth will be intensified by effects of erosion and abrasion. Such damages can be observed in bruxists and are by no means of caries etiology (Figure 6, 7) (19-22).

Etiopathogenesis

Tooth wear is not a complex pathological phenomenon of non-cariious origin, not only from a tribological point of view. From the review of scientific literature it is obvious that there are differences in the occurrence of certain clinical entities of tooth wear as predominant pathological processes leading to surface loss; attrition is a more commonly used term in North America whereas erosion is used in Europe, yet the unique model explaining the etiopathogenesis of tooth wear has not yet been designed (23). These include the following factors:

General health and diseases of the digestive system

General health does not have to be a direct etiopathogenetic factor of tooth wear, for example tooth surface loss has been observed in psychiatric patients, which is explained by higher frequency of oral parafunctions (24). However, children with special needs (for example those with Down's syndrome), manifest significantly more signs of tooth wear due to attrition and erosion (25). Erosion is caused by diseases of the digestive system leading to gastroesophageal reflux of gastric juice (for example bulimia nervosa) due to acidification of oral medium resulting in non-cariious enamel demineralization. Intrinsic erosion can result from pathologically changed function of salivary glands and composition of saliva (26-28).

Oral hygiene measures

Tooth wear while brushing the teeth with a toothbrush will depend on the hardness of the toothbrush, ingredients of the tooth paste – abrasive particles which enhance plaque removal from tooth surfaces. It particularly depends on brushing technique (29-31).

Prehrambene navike

Iako su prehrambene navike smanjile mastika-cijsko trošenje zuba, danas prevladava mekša i manje konzistentna hrana, a različite kemijske egzogene tvari sve češće uzrokuju zakiseljavanje oralnoga medija i nastanak erozije, kao što su žestoka pića, vitamin C i sl. Prehrambene navike i ovisnosti (gazirana pića, limunski napici, alkoholna pića) i način njihova konzumiranja - srkanje na slamčicu te njihovo duže zadržavanje u ustima - izravan su uzročnik erozije cakline (16, 32-37).

Nepravilno oralno ponašanje

Nepravilne oralne navike i ponašanja također mogu uzrokovati atipična trošenja zubnih ploha i cijelih zuba. Kod primitivnih se naroda radi ukrašavanja tijela strugalo i preoblikovalo zube, posebice sjekutiće (38). Loše navike, kao na primjer grickanje noktiju, pušenje lule ili stalno držanje drugih predmeta u ustima, uzrokuju specifične oblike trošenja zuba (10). Vrste poslova tijekom kojih se radni predmeti drže zubima stvaraju specifična oštećenja cakline (39). Osim korisnih anamnestičkih podataka, klinički se može lako utvrditi da antagonističke fasete odgovaraju obliku stranoga predmeta.

Dentalna erozija uzrokovana specifičnim radom u industriji, više je povijesno važna. Izloženost industrijskim elektrolitičkim procesima, primjerice u tvornici automobilskih akumulatora, može zbog onečišćenoga zraka uvjetovati dentalne erozije slične onima potaknutima prehrambenim navikama. Bolja zaštita na radu pridonosi smanjenju trošenja zuba (40,41).

Bruksizam

Bruksizam je nesvrhovita i prekomjerna aktivnost žvačnih mišića, a uzrokuje kretnje stiskanja i/ili škripanja zuba (Slika 8.). Prekomjerna i česta noćna bruksistička aktivnost, za razliku od fiziološke mišićne aktivnosti tijekom sna, nefiziološki troši zubne plohe. Dnevni bruksizam u cijelosti je nefiziološki i teži oblik abnormalne mišićne aktivnosti. U multifaktorijalnoj i često spornoj etiologiji razlikuju se periferni (morfološki) i centralni (psihološki i patofiziološki) etiološki čimbenici bruksizma. (42,43).

Dietary habits

Although dietary habits diminished the frequency of masticatory tooth wear (the consumed food is softer and less consistent), different extrinsic chemical substances such as hard alcohol, vitamin C, etc., frequently cause acidification of oral medium and erosion. Dietary habits and addictions (carbonated beverages, citric beverages, alcoholic drinks) and the way of their consumption (sipping by using a straw, holding or "swilling" the drink within the palatal vault instead of direct swallowing) are direct causative factors of enamel erosion (32-37).

Inappropriate oral behavior

Inappropriate oral habits and behaviors can also cause atypical tooth surface loss as well as loss of entire teeth. It is a known fact that as early as in primitive societies scraping and remodeling of teeth, particularly incisors, was performed for the purpose of ornamenting the body (38). Inappropriate habits such as nail biting, pipe smoking and habitual holding of some other objects in the mouth causes specific patterns of tooth wear (10). Different types of jobs in the course of which different objects are held by teeth result in formation of specific patterns (needle and thread at tailor's, nails at blacksmith's, builder's and carpenter's, etc.) (39). In clinical practice, apart from useful anamnestic data, causes of the tooth wear of the mentioned kind may be easily determined by comparing the antagonistic facets with the shape of a foreign object.

Dental erosion caused by performing a specific job in industry is of historic importance. Exposure to industrial electrolytic processes such as, for example, work in car battery production, can produce through the contaminated air of the work environment erosive dental lesions similar in pattern to those caused by dietary habits. Better safety measures at work contribute to the decrease in prevalence of tooth wear of such a causative factor (40, 41).

Bruxism

Bruxism implies futile and excessive activity of masticatory muscles, which causes clenching movements and/or grinding of teeth (Figure 8). Excessive and frequent nocturnal bruxist activity, unlike physiological muscle activity during sleep, results in non-physiological wear of tooth surfaces. Diurnal bruxism is completely non-physiological and more severe form of an abnormal muscular activity. In the multifactorial and often controversial etiology the peripheral (morphological), central (psychological)



Slika 8. Kontinuirana istrošenost zubnih ploha i bridova zbog bruskizma kod 22-godišnje žene
Figure 8 A permanent wear of tooth surfaces and edges due to bruxism in a 22-year-old female patient.

Bruksizam je povezan s mnogobrojnim patofiziološkim čimbenicima. Tijekom spavanja može se dogoditi iznenadno buđenje ili promjena dubine sna – tada dolazi do generalizirane promjene aktivnosti u tijelu: ubrzanog rada srca, promjene ritma disanja, periferne vazokonstrikcije i mišićne hiperaktivnosti, uključujući i bruksizam. Promjene u sustavu centralnih neurotransmitera u nigrostriatalnoj projekciji mogu uzrokovati poremećaj mišićne aktivnosti. Farmakološka terapija također utječe na induciranje bruksizma (na primjer L-dopa i neuroleptici). Mnogobrojne tvari, kao na primjer amfetamini, amfetaminima slične tvari, nikotin i alkohol mogu biti etiološka podloga za razvoj bruksizma, što se posebice objašnjava djelovanjem preko dopaminskog sustava. Poremećaj ponašanja i afektivni psihološki čimbenici, od kojih je najviše izražena anksioznost, mogu zajedno s emocionalnim stresom pod utjecajem psihosocijalnih čimbenika, uzrokovati bruksističnu aktivnost (42-44).

Temporomandibularni poremećaji

Trošenje zuba u mogućoj je međuovisnosti s pojavom temporomandibularnih poremećaja i oblika muskuloskeletalnog poremećaja praćenog bolovima i disfunkcijom žvačnih mišića i čeljusnih zglobova. Teško je utvrditi njihovu povezanost s obzirom na obostranu mulifaktorijsku etiologiju te psihosocijalnu komponentu bruksizma i temporomandibularnih poremećaja. Bruksizam najčešće smatramo potencijalnim čimbenikom rizika i/ili etiološkim čimbenikom razvoja temporomandibularnih poremećaja, premda to nije dovoljno znanstveno potvrđeno (45,46).

Jatrogeno trošenje zuba

Restauracijski materijali također imaju određena, često neodgovarajuća fizikalna svojstva, po-

and pathophysiological) etiologic factors of bruxism are differentiated (42, 43).

Bruxism is related to a number of pathophysiological factors. During sleep either a sudden awakening or a change in sleep intensity may occur – resulting in a generalized change of activity in the human body: increased heart rate, changes in breathing rhythm, peripheral vasoconstriction and muscular hyperactivity also including bruxism. Changes in the central neurotransmitter system in the nigrostriatal projection can cause a disorder of muscular activity. Pharmacological therapy also affects the induction of bruxism (for example, L-dopa and neuroleptics). A number of substances such as amphetamines, amphetamine-like substances, nicotine and alcohol can be an etiological background for bruxism development which is particularly explained by effects via dopamine system. Behavioral disorders as well as affective psychological factors, the anxiety being the most prominent, together with emotional stress, affected by psychosocial factors, can cause bruxist activity (44, 45).

Temporomandibular disorders

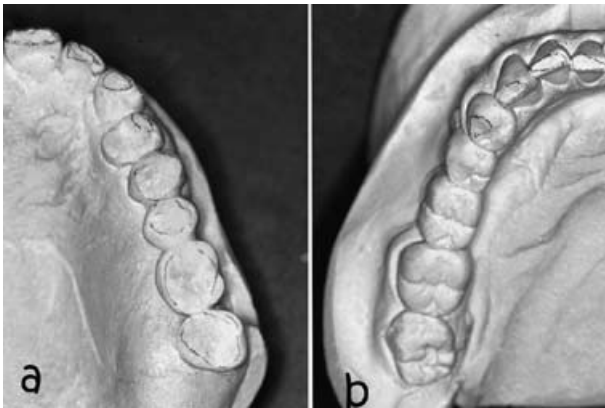
The correlation between tooth wear and temporomandibular disorders is possible, which are expressed as a form of musculo-skeletal disorder accompanied by pains and dysfunction of both the masticatory muscles and temporomandibular joints. This correlation is difficult to determine considering their multifactorial etiologies as well as psycho-social component of bruxism and temporomandibular disorders. Bruxism is most commonly considered a potential risk factor and/or etiological factor of temporomandibular disorders development, which was not sufficiently supported by scientific evidence (45, 46).

Iatrogenic tooth wear

Restorative materials also have certain, often insufficiently investigated, physical properties, par-

sebece tvrdoću. Materijali mekši od zubne cakline (kompozitni ispuni, akrilatni protezni zubi, akrilatne fasete i okuzijske plohe krunica i mostova i dr.) znatnije će se trošiti, dok će caklina antagonističkih zuba biti intaktna. Ako je restauracijski materijal veće tvrdoće od cakline (na primjer keramički mostovi i krunice te keramički protezni zubi), trošit će se isključivo antagonističke zubne plohe (Slika 9.).

Primjena aloplastičnoga restauracijskog materijala mora uzeti u obzir i tribološka djelovanja u okuzijskim odnosima s antagonistima. S obzirom na funkcijske i estetske zahtjeve restauracijske stomatologije, tek manji dio materijala je s ograničenom indikacijom (amalgam, većina dentalnih legura i dr.) (47).



ticularly hardness. Hardness is the most important property of the teeth which induces the mechanism of tooth wear. Materials which are softer than tooth enamel (composite fillings, acrylic pontics in dentures, acrylic facets and occlusal planes in crowns and bridges, etc.) will wear out to a greater extent whereas enamel of antagonist teeth will remain intact. If the restorative material has a greater hardness than enamel (for example, ceramic bridges and crowns and ceramic pontics in dentures), only the antagonist teeth surfaces will undergo tooth wear (Figure 9).

Tribological effects in occlusal relations with antagonists must be considered when aloplastic restorative materials are used. With regard to functional esthetic criteria of restorative dentistry, only a small number of materials with limited indication of application have an adequate hardness compared to tooth enamel (amalgam, most dental alloys, etc.) (47).

Slika 9. Keramički most u donjoj čeljusti (b) uzrokovao je trošenje okluzijskih ploha antagonističkih zuba u gornjoj čeljusti (a) kod 42-godišnje pacijentice
Figure 9 Ceramic bridge in the mandible (b) caused the wear of occlusal surfaces of antagonistic teeth in the maxilla, (a) in a 42-year-old female patient.

Klinička važnost trošenja zubnih površina

Klinički je teško razlučiti granicu između fiziološkoga i patološkoga trošenja zubnih tkiva. U svakom slučaju sukcesivno trošenje zuba ima multifaktorijalnu etiologiju, a u ovome radu opisani tribološki mehanizmi mogu biti međusobno u sinergijskom djelovanju, a ono se s vremenom pojačava. Važno je razlučiti koji se mehanizmi nastanka habitualnog, ali i patološkog trošenja, mogu najlakše ukloniti te koliko će ti uzročnici negativno djelovati na planirano restauracijsko liječenje. Etiopatogenetski i morfološki odnosi pojedinih oblika trošenja zuba te njihove estetske posljedice, nisu potpuno istražene. Predlaže se u odgovarajućim slučajevima uporaba, na primjer, termina „nekariozne cervikalne lezije“, jer je utvrđena njihova povezanost s nastankom brusnih faseta. Određivanje specifičnih uzroka nastanka pojedinog oblika trošenja zuba i njegova međudnosa, istodobno s drugim oblicima, trebalo bi biti predmet daljnjih istraživanja (48,49).

Clinical Importance of Tooth Surface Wear

It is difficult to clinically distinguish the physiological from pathological wear of dental tissues. Anyway, the successive tooth wear has a multifactorial etiology which is also described in this paper wherein tribological mechanisms act synergistically and the effects are intensified over time. Apart from putative causes, it is important to determine which conditions and mechanisms of habitually or pathologically induced tooth wear can be the easiest to eliminate. So far, the etiopathogenic and morphological relations between different types of tooth wear as well as their esthetic consequences have not been entirely investigated. In certain cases the use of the term “non-carious cervical lesions” is suggested because their relationship with polished facets has been established. More research is needed (48, 49).

Tooth wear in the masticatory system as a dynamic system of organs can be related to osteoar-

U žvačnom sustavu može se trošenje zuba povezati i s osteoartritičnim promjenama čeljusnih zglobova (50). Takva oštećenja pronađena su na skeletalnim nalazima ljudi u razdoblju od neolita do srednjega vijeka.

Podaci o prevalenciji kliničkih znakova trošenja zuba različiti su, što se može tumačiti brojem ispitanika obuhvaćenih studijama, izborom i primjenom odgovarajućih tehnika te instrumenata za mjerenje i činjenice da se trošenje zuba lakše uočava kod starijih osoba (2).

Suvremeni način života donosi psihološka opterećenja te nepovoljne promjene prehrambenih i oralnih navika. Djelotvorna prevencija je i upozoravanje na znakove patološkog trošenja zuba već od dječje i adolescentske dobi (51). Pacijenti na početku nisu svjesni neprimjetnih, ali ireverzibilnih promjena oblika i funkcije zuba.

Zaključak

Kako se mijenjaju prehrambene navike ljudi (manji unos konzistentne hrane, trošenje gaziranih pića i sl.) postaju izraženiji psihosocijalni uvjeti koji stvaraju i somatske poremećaje (na primjer stresni poremećaj, anksioznost). Oštećenje zuba uvjetuju interakcija opisanih potencijalnih uzročnika i njihova najčešće sinergičkog učinka i sinkroniziranog djelovanja tijekom dužeg razdoblja. Pravodobno dijagnostičiranje mehanizama koji uzrokuju prekomjerno trošenje zuba te predviđivosti zbivanja s obzirom na postojeće restauracijske zahvate na zubima, iznimno su važni za restauracijske zahvate.

Zahvala

Rad je pripremljen u sklopu znanstvenih projekata broj 065-0650445-0441/065-0650448-0438 Ministarstva znanosti, obrazovanja i športa Republike Hrvatske.

thritic changes in temporomandibular joints (50). This was evidenced in skeletal findings of people from Neolithic to Middle Ages.

Data on prevalence of clinical signs of tooth wear correlate only partially which can be explained by a number of subjects included into studies, by choice and use of adequate measuring instrument and by the fact that tooth wear can be more easily detected in elderly patients (2).

Signs of pathological tooth wear should be pointed to as early as in childhood and adolescence due to the modern way of living which imposes strong psychological pressure as well as sudden changes in dietary and oral habits. This should be one of the aspects of a more efficient prevention (51). Initially, patients are generally not aware of slow but irreversible effects on both morphology and function of the teeth.

Conclusion

Changes in dietary habits (smaller intake of wholesome food, consumption of carbonated beverages, etc.) together with psychosocial conditions of modern life which also produce somatic disorders (e.g. stress disorder, anxiety, somatization disorder, etc.) are basis for interaction between clinical entities of tooth wear. Abrasion, attrition, erosion and abfraction can be considered disorders of unspecified etiopathogenesis. Most commonly they have a synergistic effect due to their synchronized action over longer periods of time. It is of utmost importance for restorative dental disciplines, as well as for occlusal therapy, to detect the mechanisms which caused excessive tooth wear on time as well as to predict further development with respect to existing and planned restorative procedures on teeth.

Acknowledgment

This paper is a part of the scientific projects No. 065-0650445-0441/065-0650448-0438 supported by the Ministry of Science, Education and Sports, Republic of Croatia.

Abstract

This paper is an overview on different interpretation of tooth wear, clinical appearance and etiopathogenic models. A process of tooth wear on the ultrastructural level of dental surfaces may be explained by tribological mechanisms, clinically classified as: attrition, abrasion, erosion and abfraction. There are some difficulties in clinical differentiation of certain processes of hard dental tissue wear due to multifactorial etiology and synergistic effects of different mechanisms of tooth wear together with synchronized action over a longer period of time. In order to predict further actions with regard to both existing and planned procedures used during the period of oral rehabilitation, it is important to detect the mechanism which caused the loss of dental tissue, which should ensure clinical success.

Received: February 23, 2007

Accepted: June 11, 2007

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Key words

Tooth Wear; Tooth, Attrition; Tooth, Erosion; Tooth, Abrasion

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