

Minimalno interventna stomatologija: Klasifikacija kaviteta

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Minimal intervention dentistry: Cavity classification

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U poslednje vreme pojam “minimalno interventne stomatologije” koristi se za opis novog pristupa u lečenju rane karijesne lezije. Model pojave karijesne lezije i njen razvoj kroz gleđ i dentin poznat je dugo godina i određivao je metode korišćene terapije. Međutim, čisto hirurški pristup kontroli karijesa, prema učenju GV Blacka¹ danas se smatra previše destruktivnim kao prvi korak terapije. Relativno je neefikasan, jer ne leči bolest pa je glavni problem što može da dovede do stalnog procesa u restaurativnoj stomatologiji pri kojem kavitet postaje sve veći te je ispun izložen sve većem opterećenju i zub postaje slabiji.

Minimalna intervencija znači da veći naglasak treba da se stavi na obuku i usmeravanje pacijenata na samostalnu negu sa primarnom namerom sprečavanja ili lečenja bolesti i otklanjanja ili minimalizovanja potrebe za hirurškom intervencijom. Danas se lečenje lezije smatra mogućim pod uslovom da nije uznapredovala do stadijuma površinskog kaviteta. Ovo ne znači da je ovaj pristup lakši od tradicionalnog hirurškog, ali omogućava znatno veće očuvanje zubnog tkiva i znatno veću dugotrajnost zuba uopšte. Takođe se sugeriše da je potpuno neprihvatljivo žrtvovati prirodno zubno tkivo preparacijom relativno velikih kaviteta pod pretpostavkom da će to u svakom slučaju da spreči dalji razvoj oboljenja.

Znanje potrebno za prihvatanje ove nove filozofije prikuplja se niz godina, a načela su već dovoljno korišćena u praksi da mogu da se smatraju ispravnim. U naučnoj literaturi postoje brojni članci u poslednjih 20 godina koji pridaju veću važnost preventivnim merama i modifikovanom oblikovanju kaviteta te danas postoji barem tri udžbenika^{2,3,4} koji detaljnije obrađuju tu temu. Stari koncept “preventivnog proširivanja kaviteta” nesumnjivo u ovom trenutku treba odbaciti, ali potvrđeno je da postoji potreba za daljim istraživanjem načela oblikovanja kaviteta koja bi ga zamenila.

In recent times the term “Minimal Intervention Dentistry” has been coined to describe a new approach to the restoration of early carious lesions. The pattern of attack of the carious lesion and its progress through the enamel and dentine has been understood for many years and has tended to dictate the treatment methods used. However, the purely surgical approach to caries control, as taught by GV Black¹, is now recognised as being far too destructive to be used as the first line of defense. It is relatively inefficient because it does not cure the disease and the major problem is that it may lead to a continuing process of replacement dentistry wherein the cavity just gets larger, the restoration is subjected to an increasingly heavy load and the tooth gets weaker.

Minimal intervention means that there should be greater emphasis upon education and direction of patients towards self care with the intention of preventing or healing the disease in the first place and eliminating, or minimising the need for surgical intervention. It is now recognised that it is quite possible to heal a lesion providing it has not progressed to the stage of surface cavitation. It is not suggested that this approach is any easier than traditional surgery but it is far more conservative of tooth structure and offers the possibility of far greater longevity for the dentition in general. It also suggests that it is completely unacceptable to sacrifice natural tooth structure by the preparation of relatively large cavities on the assumption that this will, in any way, prevent further disease.

The knowledge required for the adoption of this new philosophy has been accumulating for a number of years and the principles have been utilised in enough practices to suggest that they are sound. There have been many articles in the scientific literature over the last 20 years suggesting greater emphasis on preventive measures and modified cavity designs and there are now at least three text books^{2,3,4} covering the subject in some detail. There is no doubt that the old concept of “extension for prevention” should, at this point, be discarded but it is acknowledged that there is a need for further investigation into the cavity designs proposed to take its place.



Slika 1. Presek artikuliranih modela pacijenta sa srednje velikim amalgamskim ispunima na oba kutnjaka antagonista koji su duboko urezani za «poboljšanje» anatomskog izgleda ispuna. Rezultat je duboka interkuspidacija i gubitak lingvalne kvrčice donjeg kutnjaka.

Figure 1. Cross section of articulated models of a patient with moderately extensive amalgams in both opposing molars that had been deeply over carved to "improve" the appearance of the anatomy of the restorations. The result was deep intercuspidation and loss of the lingual cusp of the lower molar.



Slika 2. Donji kutnjak pacijenta prikazan na Slici 1. Centralna jamica amalgamskog ispuna duboko je urezana, a lingvalna kvrčica je izgubljena.

Figure 2. The lower molar of the patient shown in Figure 1. The central fossa of the amalgam is deeply overcarved and the lingual cusp has been lost.



Slika 3. Donji kutnjak s amalgamskim ispunom koji je duboko urezan, verovatno kako bi bolje izgledao. Međutim, kao posledica toga lingvalne kvrčice su ugrožene.

Figure 3. A lower molar showing an amalgam restoration that has been deeply over carved, presumably to make it look better. However, the lingual cusps are at risk as a result



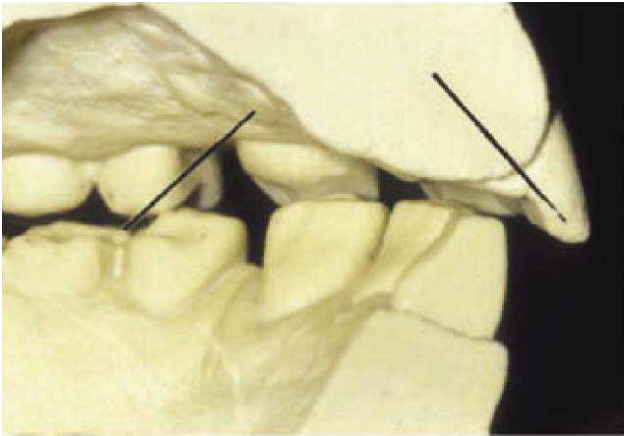
Slika 4. Donji kutnjak prikazan na Slici 3. posle odstranjenja amalgamskog ispuna. U dnu lingvalne kvrčice je pukotina koja se proteže celom dužinom zuba od mezijalno prema distalno. Treba izraditi zaštitni ispun.

Figure 4. The lower molar shown in Figure 3, following removal of the amalgam restoration. There is a split at the base of the lingual cusps running the length of the tooth from mesial to distal. A protective restoration will need to be constructed

Razumljivo je da se ni jedan materijal za ispun ne može smatrati trajnim te da će i dalje biti pucanja zubnog tkiva ili ispuna. Svaka lezija sa ispunom izložena je riziku da postane veća, barem iz razloga što će preostalo zubno tkivo da oslabi zbog preparacije kaviteta. Svakim ispunom ciklus će brže doći do novog stadijuma pucanja i ispuna. Važno je napomenuti da svaka promena okluzalne anatomije zuba, kao što je postavljanje ispuna, može da promeni okluzalni sklad. Čak i manja promena okluzalne anatomije može da izazove preveliko opterećenje na ostale nagibe kvrčice [Slike 1.-4.], razvoj preranih nagiba i funkcional-

It is understood that no restorative material can be regarded as permanent, and that there will, in time, be further breakdown of either tooth structure or restoration. Any restored lesion is at risk of becoming larger, at least because the remaining tooth structure will be weakened by cavity preparation. With each replacement, the cycle is likely to move faster to the next stage of breakdown and replacement. Significantly, any alteration to the occlusal anatomy of a tooth, through placement of a restoration, may lead to changes in occlusal harmony. Even a minor change in occlusal anatomy can lead to the introduction of undue stress on remaining cusp inclines [Figures 1-4], to the development of deflective inclines and to functionally opening contacts

no otvorenih kontakata [Slike 5, 6.] – sve to će ubrzati slabljenje okluzije i izazvati i parodontalne probleme. Zato je logično u prvom redu da se očuva što više prirodne zubne krune i lečiti leziju na vrlo pažljiv, “štedljiv” način.



Slika 5. Presek kroz artikulirane modele pokazuje donju vilicu u retrudiranom kontaktnom položaju. Obratiti pažnju da se početni kontakt nalazi između distalnog nagiba donjeg očnjaka i mezijalnog rubnog grebena gornjeg pretkutnjaka. Amalgamski ispun postavljen je mezijalno od pretkutnjaka i rubnog grebena i oblikom omogućava retenciju distalnog ugla očnjaka. Rezultat je da se gornja vilica pomera prema napred i gore do interkuspidacijskog položaja gde se zaključa i vrši silu na lingvalnu stranu gornjih prednjih zuba.

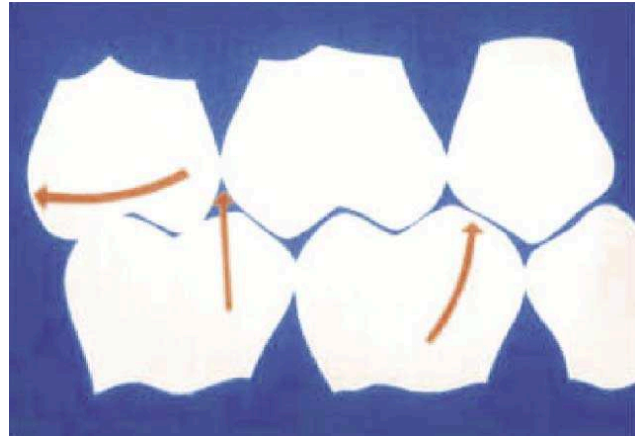
Figure 5. A cross section through articulated models showing the mandible in the retruded contact position. Note the initial contact is between the distal slope of the lower canine and the mesial marginal ridge of the upper bicuspid. An amalgam restoration has been placed in the mesial of the bicuspid and marginal ridge shaped to allow retention of the distal corner of the canine. The result is that the mandible is thrust forward and upward to the intercuspal position where it becomes locked and exerts considerable strain on the lingual of the upper anteriors.

Nova klasifikacija

Koncept minimalno interventnog oblikovanja kaviteta ne bi trebalo da bude teško prihvatiti i zamisliti kao zamenu tradicionalne GV Blackove klasifikacije. Uostalom ona predstavlja klasifikaciju **kaviteta** pri čemu je oblikovanje kaviteta specifično za svaku leziju pod pretpostavkom da će amalgam biti glavni materijal izbora za ispun. Međutim, poslednjih godina poznavanje procesa razvoja karijesa i materijala koji se koriste za ispun lezija značajno se promenilo te je sada prihvaćeno da infektivna bolest ne može da se leči hirurški.

Ako se minimalna intervencija prihvati kao filozofija, smatra se da postoji potreba za potpuno novom klasifikacijom koja će određivati **lezije** umesto kaviteta. Nije potrebno ni poželjno da se posebno ističe, specifikuje bilo koji oblik kaviteta koji bi trebalo da se izradi za ispun glatke površine zubne krune. U prvom redu je poželjno da se odredi lezija pre izrade kaviteta tako da se može lečiti remineralizacijom i zatim kontrolisati dok

[Figures 5,6] - all of which will speed the decline of the occlusion and may lead to periodontal problems as well. It is logical, therefore, to retain as much of the original tooth crown as possible in the first place and deal with a lesion in need of repair in a very conservative manner.



Slika 6. Dijagramski prikaz funkcionalno otvorenog kontakta. Distalni nagib na mezijalnim kvrčicama donjeg kutnjaka može postati dominantan. Susreće se s mezijalno okrenutim nagibom mezijalnih kvrčica gornjeg kutnjaka i pacijentovim zauzimanjem retruzijskog kontaktnog položaja gornji kutnjak se pomera distalno i kontakt se otvara i omogućava ostacima hrane ulaz u to područje. Hrana je zarobljena kad pacijent pomera u interkuspidacijski položaj.

Figure 6. A diagrammatic explanation of a functionally opening contact. A distally facing incline on the mesial cusps of the lower molar has been allowed to become dominant. It now meets the mesially facing incline on the mesial cusps of the upper molar and as the patient adopts the retruded contact position the upper molar is forced distally and the contact is opened allowing food debris to be forced into this area. The food is trapped when the patient moves into the intercuspal position

New Classification

The concept of minimal intervention cavity designs should not be difficult to accept and visualise as a replacement for the traditional GV Black classification. After all, the latter is a classification of **cavities** wherein the cavity design is specified for each lesion in the expectation that amalgam will be the primary material of choice for restoration. However, in recent years the understanding of the caries process and the materials used to repair the lesions have both changed considerably and it is now accepted that an infectious disease cannot be cured by surgery.

It is suggested that, if minimal intervention is to be adopted as a philosophy, there is a need for an entirely new classification that will identify **lesions** rather than cavities. It is neither necessary nor desirable to specify any particular design for the cavity that may have to be prepared to restore the smooth surface of the crown of a tooth. In the first place it is desirable to identify a lesion before it becomes cavitated so that it can be subjected to treatment by remineralisation and subsequently kept under observation until healed.

ne zaceli. Međutim, prihvaćeno je da je u slučaju gubitka površinskog integriteta i kaviteta potrebna hirurška intervencija. Međutim, ta intervencija treba da obuhvati jednostavno odstranjivanje površinskog kaviteta i osigura da materijal za ispun dobro zapečati rubove sprečavajući moguće rubne pukotine. Preostala bakterijska infekcija u kavitetu izoliraće se i dalje širenje će da se spreči, što dovodi do stagnacije unutar lezije. Stoga samo položaj i veličina lezije određuju oblik kaviteta i materijal koji se koristi za ispun, a ne prethodno određeni geometrijski oblik kaviteta.

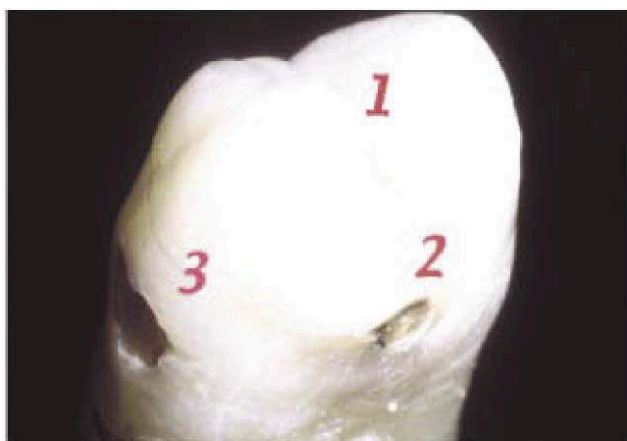
Problem GV Blackove klasifikacije uvek je bio što određuje leziju i preporučuje potrebni oblik kaviteta bez obzira na njenu veličinu. Konačan rezultat je da se bez obzira na veličinu lezije odstranjuje standardna količina zubnog tkiva bez obzira je li optećeno ili ne. To znači da je početni kavitet često veći nego što je potrebno, pa ispuni postaju sve veći. Takođe treba napomenuti da GV Blackova klasifikacija ne uzima u obzir tu progresiju i struci je teškoda dobije priznanje sve veće složenosti koju zahteva ispun proširene lezije. Taj je problem uzet u obzir u predstavljenom novom pristupu u korist pacijenata i struke.

Sledeća klasifikacija prvi put predstavljena je u članku u Quintessence International 1997. godine i posle toga proširena u udžbeniku², a zatim modifikovana u drugim člancima i pismu uredniku⁵. Koncept je dostavljen Federation Dentaire Internationale za odobrenje i prihvaćen je u nekoliko zemalja u svetu. Trenutno se predaje paralelno s GV Blackovom klasifikacijom, jer će još mnogo godina biti potrebno da se potpuno razumeju oba sistema za pravilno lečenje pacijenata. Očigledno će uvek da postoji potreba za restaurativnom stomatologijom, pa će se i kavitetima koji se temelje na GV Blackovom oblikovanju baviti još duže vreme.

However, it is accepted that, following loss of surface integrity and cavitation, there will be a need for surgical intervention. But this intervention should be designed to simply eliminate surface cavitation and to ensure that the restorative material can properly seal the margins against any potential microleakage. Remaining bacterial infection within the cavity will be isolated and further invasions will be prevented leading to stasis within the lesion. Thus the cavity design, and the material used to repair it, should be dictated solely by the position and extent of the lesion rather than any pre-ordained geometric cavity design.

There has always been a problem with the GV Black classification because it identifies a lesion and prescribes the required cavity design regardless of size. The end result is that, regardless of the extent of the lesion, there is a standard amount of tooth structure removed whether it is involved with the disease or not. This means that the initial cavity is often larger than it needs to be so subsequent replacements become larger still. It must also be noted that the GV Black classification does not make allowance for this progression and it is difficult for the profession to gain proper recognition for the increasing complexity posed by restoration of the enlarging lesion. This problem is taken into account with the proposed new approach, to the advantage of both the patient and the profession.

The following classification was first proposed in an article in Quintessence International in 1997 and subsequently enlarged upon in a text book² and then modified in other articles and a Letter to the Editor⁵. The concept has been submitted to the Federation Dentaire Internationale for approval and it has been accepted in several countries around the world. It is currently being taught in parallel with the GV Black classification because for many years there will be a need for full understanding of both systems for the proper treatment of our patients. There will obviously always be a need for replacement dentistry so there will be cavities, based upon GV Black designs, still to be dealt with for a long time yet.



Slika 7. Krunica očnjaka pokazuje tri položaja u kojima karijesna lezija često započinje. To su fisure, kontaktna područja i gingivna trećina krunice.

Figure 7. The crown of a bicuspid demonstrating the three positions at which carious lesion are likely to be initiated. These are the fissures, the contact areas and the gingival one third of the crown.

	Br.	minimalni	srednji	veći	prošireni
VELIČINA	0	1	2	3	4
MESTO					
jamica/ fisura	1.1	1.2	1.3	1.4	1
kontaktno područje	2.1	2.2	2.3	2.4	2
cervikalno	3	3.1	3.2	3.3	3.4

Slika 8. Grafikon nove klasifikacije. To je alternativa dijagrama prikazanog u tekstu.

Tablica 1 [Slika 8.] pruža dijagramski prikaz predložene klasifikacije, a u nastavku je objašnjenje brožčanog sistema koji se koristi -

Mesto lezije

Karijesne lezije nastaju samo na tri različita mesta na površini zubne krunice (Slika 7).

Mesto 1 – jamice i fisure na okluzalnoj površini bočnih zuba i ostala oštećenja glatke površine gleđi.

Mesto 2 – kontaktno područje između bilo kojeg para zuba, prednjih ili bočnih.

Mesto 3 – cervikalna područja vezana za gingivna tkiva uključujući izložene površine korena.

Veličina lezije

Zanemarena lezija nastaviće da se širi kao područje demineralizacije u odnosu na jedno od gore navedenih mesta. Širenjem se povećava složenost ispuna. Veličina može odmah da se odredi kako sledi:

Veličina 0 – početna lezija na bilo kom mestu koja se može utvrditi, ali još nije rezultirala površinskim kavitom – moguće je lečenje.

Veličina 1 – najmanja minimalna lezija koja zahteva operativnu intervenciju. Kavitet više ne može da se leči putem remineralizacije.

Veličina 2 – kavitet umerene veličine. Još uvek ima dovoljno zdravog zubnog tkiva za očuvanje integriteta preostale krunice i prihvatanje okluzalnog opterećenja.

Veličina 3 – kavitet treba modifikovati i povećati kako bi se preostala kruna zaštitila od okluzalnog opterećenja. U bazi kvržice već postoji pukotina i ako se ne zaštititi verovatno ćeda se raširi.

Veličina 4 – kavitet je proširen zbog gubitka kvržice bočnih zuba ili incizalne ivice prednjih zuba.

SIZE		No Cavity	Minimal	Moderate	Enlarged	Extensive
		0	1	2	3	4
SITE	Pit & fissure 1	1.0	1.1	1.2	1.3	1.4
	Contact area 2	2.0	2.1	2.2	2.3	2.4
	Cervical 3	3.0	3.1	3.2	3.3	3.4

Figure 8. The chart of the new classification. This is an alternative to the diagramme shown within the text.

Table 1 [Figure 8] shows a diagrammatic representation of the proposed classification and the following is an explanation of the number system that is used –

Lesion Site

Carious lesions occur in only three different sites on the surface of the crown of a tooth (Figure 7).

Site 1 - the pits and fissures on the occlusal surface of posterior teeth and other defects on otherwise smooth enamel surfaces.

Site 2 - the contact areas between any pair of teeth, anteriors or posteriors.

Site 3 - the cervical areas related to the gingival tissues including exposed root surfaces.

Lesion Size

A neglected lesion will continue to extend as an area of demineralisation in relation to one of the Sites noted above. As it extends so the complexities of restoration will increase. The sizes that can be readily identified are as follows

Size 0 – the initial lesion at any Site that can be identified but has not yet resulted in surface cavitation – it may be possible to heal it.

Size 1 – the smallest minimal lesion requiring operative intervention. The cavity is just beyond healing through remineralisation.

Size 2 – a moderate sized cavity. There is still sufficient sound tooth structure to maintain the integrity of the remaining crown and accept the occlusal load.

Size 3 – the cavity needs to be modified and enlarged to provide some protection for the remaining crown from the occlusal load. There is already a split at the base of a cusp or, if not protected, a split is likely to develop.

Size 4 – the cavity is now extensive following loss of a cusp from a posterior tooth or an incisal edge from an anterior.

Opis oblika svakog mesta i veličine uključuje se u nastavne članke, ali treba da se razmotre sledeća zapažanja.

Lezija mesta 1, veličine 0 karakteriše primarno okluzalna fisura na novoizniklom zubu koji još nije kariozan. Ova situacija može da zahteva oprezne kliničke odluke, jer je okluzalna površina bočnih zuba vrlo osetljiva na opterećenje prilikom žvakanja sa mogućnošću potiskivanja bakterijskog plaka duboko u fisuru. Anatomija fisure je uopšteno vrlo krivudava i odstranjenje plaka nije jednostavno, pa su ta područja vrlo osetljiva na brz napad karijesa kod pacijenata sa aktivnim karijesom. Ovo upućuje da pečačenje fisura bez hirurške preparacije može odmah da se opravda. S druge strane u odsutnosti bolesti rizik je minimalan i lečenje ne mora da bude opravdano. Zato je racionalno ispitati pacijenta na osetljivost prema karijesu.

Do vremena kada lezija mesta 1 postigne veličinu 1 neki oblik ispunja je obavezan, jer će te lezije biti pod stalnim okluzalnim opterećenjem i teško ih je održati bez nakupljanja plaka. Vrlo mala pukotina u sistemu fisura može da izazove brzo i opsežno zahvatanje dentina.

Lezija mesta 2, veličine 0 s druge strane načelno ne zahteva ispun u ranom stadijumu, jer ta površina nije pod okluzalnim opterećenjem. Najveći rizik za tu leziju je ispitivanje oštrom sondom, jer ona može da ošteti površinu, koja je već demineralizovana te će ispun biti jedina metoda njenog pečačenja. Rana lezija bele mrlje treba oprezno da se leči i treba sve da se preduzme da lezija zaceli uz pomoć edukacije pacijenta i remineralizacije.

Lezije veličine 1 i veličine 2 na sva tri mesta načelno predstavljaju početne lezije i u mnogim slučajevima mogu da se leče korišćenjem minimalnih oblika kaviteta i ispunom iz jednog ili oba adhezivna materijala za ispun koji su trenutno dostupni. Kad lezija dostigne kategoriju veličine 3 ili više, gotovo sigurno treba da se primeni "restaurativna stomatologija" te će čvršći materijal za ispun često biti indukovano. Kod lezija mesta 1 i mesta 2 većih veličina biće potrebna zaštita ili ispun kvržica te to zahteva složenije restaurativne tehnike. Treba da se istakne da ova klasifikacija, za razliku od GV Blackove klasifikacije, priznaje veću složenost i time doprinosi boljim rezultatima za teže tehnike.

Prednosti

Postoji niz prednosti koje se mogu postići prihvatanjem ove klasifikacije.

1. To je jednostavni broječni sistem koji odmah može da se prilagodi računskoj evidenciji.
2. Otkriva prisutnost karijesne lezije kao i relativnu veličinu od najranijeg stadijuma.

A description of the design of each Site and Size will be included in subsequent papers but the following observations are worth considering.

The Site 1, Size 0 is represented primarily by the occlusal fissure on a newly erupted tooth that is not yet carious. This situation may call for careful clinical decisions because the occlusal surface of a posterior tooth is very susceptible to load during mastication with the potential for forcing bacteria laden plaque deep in to a fissure. The anatomy of a fissure is generally extremely convoluted and plaque removal is not easy so these areas are highly susceptible to rapid carious attack in the caries active patient. This suggests that fissure sealing without surgical preparation could be readily justified. On the other hand, in the absence of the disease there is a minimal risk and treatment may not be justifiable. Therefore, testing a patient for caries susceptibility is a rational procedure.

By the time the **Site 1** lesion reaches a **Size 1** some form of restoration is mandatory because these lesions will be under constant occlusal load and it is difficult to keep them plaque free. A very minor breach in the fissure system can lead to rapid and extensive involvement of the dentine.

The Site 2, Size 0 lesion, on the other hand, will generally not require restoration in the early stages because this surface is not under occlusal load. The greatest risk for this lesion is to be explored with a sharp probe because this may well damage the surface, which is already demineralised, and a restoration will be the only method of sealing it. The early white spot lesion should be handled with great care and every effort should be undertaken to heal the lesion through patient education and remineralisation.

The Size 1 and Size 2 lesions at all three Sites generally represent initial lesions and in many cases can be dealt with using the most conservative cavity designs followed by restoration with either or both of the adhesive restorative materials currently available. Once the lesion reaches the Size 3 category, or beyond, it is almost certainly "replacement dentistry" and a stronger restorative material will often be indicated. With Site 1 and Site 2 lesions in the larger Sizes there will be a need to protect or restore cusps and this calls for more complex restorative techniques. It should be noted that this classification, unlike the GV Black classification, recognises these increased complexities thus encouraging greater reward for more difficult techniques.

Advantages

It is suggested that there are a number of advantages to be gained from the adoption of this classification.

1. It is a simple numerical system that can be readily adapted to computer records.
2. It records the presence of a carious lesion as well as the relative dimensions from the very earliest stage.

3. Otkriva povećanu složenost tehnika koje su potrebne za ispun karijesne lezije.
4. Otkriva lezije bez specifikovanja oblika kaviteta potrebnog za ispun lezije tako da je oblik prepušten veštini i znanju stomatologa.
5. Iz tih razloga priznaje se i podstiče upotreba tehnika minimalne intervencije u obradi lezije.

Međutim, istovremeno treba da napomenemo da nije moguće da potpuno napustimo GV Blackov sistem klasifikacije kaviteta. Taj sistem je univerzalan već tako dugo da će da se primenjuje još mnogo godina. Zato ta dva sistema treba podučavati i pratiti paralelno. Međutim, s obzirom na jednostavnost i tačnost novog sistema verovatno će da postane dominantan i sistem izbora u bliskoj budućnosti.

3. It records the increasing complexity of the techniques involved in the restoration of a carious lesion.
4. It records lesions without specifying the cavity design required to repair the lesion so the design is left to the skill and wisdom of the operator.
5. It therefore recognises and encourages the use of minimal intervention techniques in dealing with a lesion.

However, it is noted at the same time that it is not possible to entirely abandon the GV Black system for the classification of cavities. This has been universal for so long that for many years to come there will be a decreasing residuum of replacement dentistry required for cavities originally designed using these principles. Therefore the two systems will need to be taught and recorded in parallel. However, in view of the simplicity and accuracy of this system it is likely that this will become paramount and the system of choice in the near future.

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