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1-я КАФЕДРА ТЕРАПЕВТИЧЕСКОЙ СТОМАТОЛОГИИ

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DENTAL CARIES: CLINICAL PICTURE, DIAGNOSIS, PREDICTION, TREATMENT

Учебно-методическое пособие

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Рассматриваются вопросы клиники, диагностики, прогнозирования и лечения кариеса зубов. Материал базируется на имеющихся в отечественной и зарубежной литературе современных представлениях по данной проблеме.

Предназначено для студентов 3-го курса медицинского факультета иностранных учащихся, обучающихся на английском языке.

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CLINICAL PICTURE OF DENTAL CARIES

Clinical manifestation of dental caries depends on the stage of the process, activity and lesion depth.

Dental caries can be divided into 4 stages:

– Initial caries: Demineralization without structural defect. This stage can be reversed by fluoridation and enhanced mouth hygiene.

– Superficial caries (Caries superficialis). Enamel caries, wedge-shaped structural defect. Caries has affected the enamel layer, but has not yet penetrated the dentin.

– Moderate caries (Caries media). Dentin caries. Extensive structural defect. Caries has penetrated up to the dentin and spreads two-dimensionally beneath the enamel defect where the dentin offers little resistance.

– Deep caries (Caries profunda). Deep structural defect. Caries has penetrated up to the dentin layers of the tooth close to the pulp.

CLINICAL

- According to the stage of lesion progression:
  Non cavitated lesion
  Cavity
- According to the severity of the disease:
  Acute caries (active)
  Chronic caries (slowly progression)
  Stabilized caries (arrested)
- According to clinical manifestation:
  White spot lesion macula caroisa
  Superficial caries caries superficialis
  Medium caries caries media
  Deep caries caries profunda
  Secondary caries caries secundaria

ANATOMICAL

- According to anatomical depth of the defect:
  Enamel caries
  Dentin caries
  Cementum caries
- According to location of the lesion:
  Coronal caries
  Occlusal surfaces
  Smooth surfaces
  Approximal surfaces
  Root caries
- According to intensity of caries within the dentition:
  Single lesion
  Multiple lesions
  Systemic destruction

The term **enamel caries** is used here as a definition of a visible disintegration of enamel surface. A noncavitated lesion is also one of the forms of enamel caries but, due to relevant clinical differences and management of noncavitated and cavitated stages of carious defects these two forms of caries are discussed separately.

Breakdown of enamel surface occurs due to progressing mineral loss, created by mechanical injuries during mastication or careless probing. A rapid progression of the tissue destruction may occur.

The newly formed cavity will harbor microbial mass and will provide favorable conditions for their metabolic activity. Especially it concerns the occlusal surfaces where development of the lesion in the deepest parts of the groove — fosse system already is protected against physical wear or any other disturbances of microbial life.

A clinical notable superficial surface discontinuity may not always be supported by a histological validation of a modest enamel demineralization. More often it shows involvement of deeper parts of hard dental tissue, including dentin.

TYPICAL LOCATION

- *Approximal surfaces* involves an interdental facet area toward the gingival margin, possible extentions buccally and lingually.
- *Occlusal surfaces* natural pitts and fissures are the most vulnerable sites. The process starts in the deepest parts of the groove fossa system, depending on tooth specific anatomy
- *Smooth surfaces* along the gingival margin

PATIENT COMPLAINTS

- Short pain as reaction to sweets or thermal agents
- Aesthetical discomfort especially in anterior teeth

CLINICAL APPEARANCE

1. *ACTIVE LESION*
   Whitish, Opaque, Chalky
   On smooth surfaces — shallow defect close to gingival margin
   Coverd by plaque
   In fissurses — local enamel defect
2. *INACTIVE LESION*
   Whitish, Yellowish, brownish
   Glossy and shiny
   On smooth surfaces with small distance from gingival margin
   Clean from plaque
   On occlusal surfaces — localized enamel defect

DIAGNOSIS

Gentle probing

Active lesion feels rough

Inactive one feels smooth and hard

Radiograph: detection of conical shape in enamel, EDJ and outer dentin are also involved.

FOTI for approximal surfaces: a shadow in the area of a carious demineralization.

Electrometrical test shows normal tooth vitality.

Caries in enamel is clearly a dynamic process, and this tissue does not contain cells and therefore is incapable of reacting in a vital manner.

As soon as the process has reached dentin there is an immediate vital response by the odontoblasts and their processes within the dentinal tubules which is assumed as defense reaction.

After reaching enamel dentin junction (EDJ), caries spreads laterally along the junction of least resistance and therefore undermines sound enamel. The established occlusal **dentinal lesion** is *conical in shape* with its basis on the EDJ and its apex directed towards the pulp.

Continuous irritation of odontoblasts processes by acids diffusing through the porous enamel or even by bacteria themselves at the stage of enamel destruction activates the pulp/dentin organ in such a way that a region of reactionary or reparative irregular dentin begins to form from the pulpal side.

In addition a mild degree of inflammation in the pulp may occur which is still reversible. But, if the bacterial invasion in the cavity continues, and the irritation of the pulp is persisting, it can cause severe inflammatory changes in the pulp which will not recover.

There are **hidden caries lesions** in some areas which are relatively well protected from mechanical pressure, the layer of clinically intact enamel can be maintained for a long time, thus hiding an ongoing demineralization in dentin.

In rare cases, if soft dentin is exposed to attrition the affected area gradually turns into a smooth and polished surface, and the caries process may become arrested.

TYPICAL LOCATION

- *Approximal surfaces* — a defect above the gingival margin, the ridge may be broken and the cavity extends to the occlusal surface.
- *Occlusal surfaces* — a defect located in the pits and fissures and involving surrounding enamel.
- *Smooth surfaces* above the gingival margin

PATIENT COMPLAINTS

- Short pain as reaction to sweets, thermal agents or mechanical pressure.
- High sensitivity on probing
- Aesthetical discomfort especially in anterior teeth

CLINICAL APPEARANCE — a gross cavity full of soft demineralized dentin.

1. Active lesion
   Light brown and dull
   On smooth surfaces — shallow defect close to gingival margin
2. Inactive Lesion
   Dark brown and shiny
   On smooth surfaces with small distance from gingival margin

DIAGNOSIS

Gentle probing

Active lesion feels soft and sticking

Inactive one feels smooth and hard

Radiograph detection of conical shape in enamel, EDJ and dentin at varying depth is usually involved, too

FOTI for approximal surfaces: a shadow in the area of a carious demineralization

Electrometrical test shows normal tooth vitality

The term **secondary caries** defines the process of caries development which occurs after treatment of the primary caries lesion.

Clinically it can be presented with all mentioned clinical manifestations, starting with a non cavitated lesion and extending further in enamel or dentin.

The reasons for formation of secondary caries are:

– Marginal gap formation between the restoration and the tooth surface

– Broken filling

– Loss of a part of the filling

– Initial caries development due to plaque accumulation around margins of the filling

DIAGNOSIS

Can be performed with the same methods as for other forms of caries but in this case the visual examination of dental surfaces should be supported with additional diagnostic tools (bite wing).

The 100 % seal of the restored surface cannot be guaranteed forever and as soon as the dentinal microbiota will obtain contact with oral environment, the destructive process in dentin towards the pulp will continue.

The marginal gap around the restorations cannot be detected with the naked eye at the initial stage but the products of microbial metabolism (acids) on the surface can penetrate the minor microporosites that appear in the restored tooth surface.

PROPERTIES AND DIFFERENCES BETWEEN ACTIVE AND ARRESTED LESIONS

ACTIVE LESIONS

Dyes permeable

Bacteria infiltrated

Acidic pH 4.9

ARRESTED LESIONS

Not permeable to dyes

Outer layer is almost bacteria free

pH is almost normal (5.7)

Mineralized surface layer present

Fluoride content on surface is higher

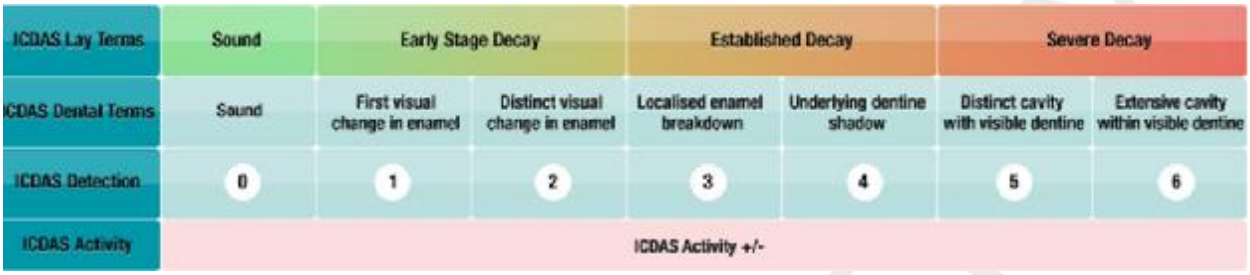
Reparative dentin formation in pulp

Pigmentation

METHOD FOR DIAGNOSIS OF DENTAL CARIES

ICDAS

ICDAS is a detection & assessment system for classifying stages of the caries process. What is ICDAS? It is a simple, logical, evidence-based system for detection and classification of caries in dental education, clinical practice, dental research, and dental public health.



For training this diagnostic system you can use the eLearning programs, located at the Internet address https://www.icdas.org/home.

VISUAL-TACTILE METHODS

The traditional method of detecting caries signs is by visual inspection of dental surfaces, with the aid of a bright light and dental mirror if necessary to see teeth from all angles. Reflecting light onto the mouth mirror can also be done to search for dark shadows that could indicate dentin lesions.

Diagnostic Criteria

While dental experts acknowledge that there is no universal set of diagnostic criteria that can be recommended for all purposes, the six most commonly used visual–tactile criteria are:

Recording cavitated lesions only. Working under the assumption that it is still not possible to reliably diagnose all non-cavitated lesions, the World Health Organization recommends that caries lesions be diagnosed at the level of cavitation only. This is done with the use of a probe. Because the focus is only on open cavities, it ignores the fact that non-operative interventions (such as fluoride) can help reduce caries risk and progression. Therefore, most dentists in developed countries today do not rely solely on this criterion.

Recording both cavitated and non-cavitated lesions. In addition to taking note of cavitated lesions that can be helped by operative intervention, taking note of non-cavitated lesions (white spots that indicate where demineralization has occurred) can help the dentist observe where non-operative intervention might be useful. Pitts and Fyffe (1988) devised the following diagnostic levels that are still used today, and devised this method with the help of a mouth mirror and probe: D1 (enamel lesion, no cavity); D2 (enamel lesions, cavity), D3 (dentin lesions, cavity), D4 (dentin lesions, cavity to the pulp).

Lesion depth assessment. To understand the classification for lesion depth assessment, it is important to know how moisture on the tooth surface affects the visibility of a lesion. White spot lesions become more opaque in dried dental

tissue compared to wet dental tissue because of increased light scattering. Typically, non-cavitated lesions that are visible on a wet tooth have penetrated deeply, while a non-cavitated lesion that is only visible after drying has penetrated less deeply into teeth.

Based on these concepts, Ekstrand et al (1997) presented a visual ranked scoring system for lesion depth assessment that is still commonly used. Using no probe, they examined tooth surfaces to devise the following diagnostic levels: no or slight change in enamel translucency after 5 seconds of air-drying; opacity or discoloration that is hardly visible on wet surfaces, but visible after 5 seconds of air drying; opacity or discoloration that is visible without air-drying; localized enamel breakdown with opaque or discolored enamel and/or grayish discoloration from underlying dentin; cavitation in opaque or discolored enamel exposing dentin.

Lesion activity assessment. This is a newer diagnostic method developed by Nyvad et al (1999) that focuses on the surface characteristics of lesions, namely activity as reflected in the surface texture of the lesion, and surface integrity, as indicated by the presence or absence of a cavity or microcavity in the surface. The rationale behind the method is that the surface characteristics of enamel change in response to changes in the biofilm covering the tooth surface. The diagnostic categories are as follows: active, non-cavitated; active, cavitated; inactive, non-cavitated; inactive, cavitated; filling; filling with active caries; filling with inactive caries. Active, non-cavitated enamel caries lesions have a whitish/yellowish opaque surface, with a chalky or neon-white appearance, and the surface feels rough when a probe is moved across it. Inactive, non-cavitated lesions, on the other hand, are shiny and can vary in color from white, brown, or black, and will feel smooth with gentle probing. Active, cavitated lesions feel soft or leathery, while inactive, cavitated lesions are shiny and feel hard with probing. In general, active, non-cavitated lesions have a higher risk of progressing to a cavity than inactive, non-cavitated lesions, which have a higher risk of becoming a cavity than healthy surfaces.

Recording root-surface caries. This is a classification specific to root caries lesions that integrates activity assessment and surface integrity assessment. The diagnostic categories are as follows: inactive lesion without surface destruction; inactive lesion with cavity formation; active lesion without surface destruction; active lesion with surface destruction (cavitation), but visually cavity does not exceed 1 mm in depth; active lesion with a cavity depth exceeding 1 mm, but does not involve pulp; lesion expected to penetrate into pulp; filling confined to root surface or extending from a coronal surface to root surface; filling with an inactive lesion (secondary) confined to the margin.

Recording recurrent caries. This refers to caries at the margins of restorations, with recurrent caries reflecting the result of unsuccessful plaque control. These are typically found on the gingival margins of all classes of restorations, with the exception of class I restorations, which affect pit-and-fissure crevices on occlusal, buccal, and lingual surfaces of posterior teeth and lingual

surfaces of anterior teeth. Diagnosis is accomplished using the Nyvad criteria in the lesion activity assessment section described previously.

Benefits of visual-tactile diagnosis

Visual-tactile diagnosis is quick and easy to perform, does not need expensive equipment, and can be completed without unnecessary radiation. Currently, activity assessment according to the criteria suggested by Nyvad et al. (1999) is considered the best choice for performing caries diagnosis, because these are the only criteria that reflect the current evidence-based management options for different phases of caries formation, and the only criteria with predictive value. Surprisingly, data show that when non-cavitated lesions are included in classification, the yield of visual-tactile caries examination is greater than that of radiographic examination because minor mineral losses cannot be detected in radiographs.

Limitations of visual-tactile lesion diagnosis

These include the fact that visual-tactile diagnosis requires subjective evaluations to be made by the practitioner, lesions can go undetected because teeth are typically examined by the naked eye, and there is need for supplemental analysis when faced with clinical signs that will leave a dentist uncertain, including dark occlusal or approximal shadows.

NEW TECHNOLOGIES FOR CLINICAL DIAGNOSIS OF EARLY DENTAL CARIES

1. Fiber-optic transillumination.
2. Digital imaging fiber-optic transillumination.
3. Quantitative light-induced fluorescence.
4. DIAGNOdent laser system.
5. Electrical caries monitor.
6. Midwest Caries I.D.
7. Polarization-sensitive optical coherence tomography.
8. CarieScan.
9. Frequency-domain infrared photothermal radiometry and modulated luminescence.
10. Cone beam computed tomography.

PREDICTION OF DENTAL CARIES

CARIOGRAM

Cariogram is a new way in which to illustrate the interaction between caries related factors. This educational interactive program has been developed for better understanding of the multifactorial aspects of dental caries and to act as a guide in the attempts to estimate the caries risk. This program can be used in a clinical set up or for various educational purposes (D. Bratthall et al., 2005).

The main purpose of the Cariogram is to demonstrate the caries risk graphically, expressed as the ”Chance to avoid new caries” (i. e. to avoid getting new cavities or “holes”) in the near future. It also illustrates to what extent various

factors affect this “Chance”. A further purpose of this program is to encourage preventive measures to be introduced before new cavities could develop.

Cariogram — aims:

– Illustrates the interaction of caries related factors.
– Illustrates the chance to avoid caries.
– Expresses caries risk graphically.
– Recommends targeted preventive actions.
– Can be used in the clinic.
– Can be used as an educational program.

Special conditions for use of the Internet Version see: http://www.db.od.mah.se/car/cariogram/cariograminfo.html

Cariogram — the five sectors.

The Cariogram, a pie circle-diagram, as seen in the screen, is divided into five sectors, (see figure below) in the following colours: green, dark blue, red, light blue and yellow indicating the different groups of factors related to dental caries. An explanation of each sector follows below.

The green sector shows an estimation of the “Actual chance to avoid new cavities”. The green sector is “what is left” when the other factors have taken their share!

The dark blue sector “Diet” is based on a combination of diet contents and diet frequency.

The red sector “Bacteria” is based on a combination of amount of plaque and mutans streptococci.

The light blue sector “Susceptibility” is based on a combination of fluoride program, saliva secretion and saliva buffer capacity.

The yellow sector “Circumstances” is based on a combination of past caries experience and related diseases.

The bigger the green sector, the better from a dental health point of view. Small green sector means low chance of avoiding caries = high caries risk. For the other sectors, the smaller the sector, the better from a dental health point of view. In summary, the Cariogram shows if the patient over all is at high, intermediate or low risk of caries. It also shows for every individual examined, which etiological factors are considered responsible for the caries risk. The results also indicate where targeted actions to improve the situation will have the best effect.

The Cariogram only expresses caries risk. It does not take into account such problems as fractures of teeth or fillings, discolorations etc that might require new fillings.

Caries related factors according to the program Factor	Comment	Info/data needed
Caries experience	Past caries experience, including cavities, fillings and missing teeth due to caries. Several new cavities that appeared during the preceding year should score “3” even if the number of fillings is low	DMFT, DMFS, new caries experience during the past one year
Related general diseases	General diseases or conditions associated with dental caries	Medical history, medications
Diet, contents	Estimation of the cariogenicity of the food, in particular fermentable carbohydrate content	Diet history, (lactobacillus test count)
Diet, frequency	Estimation of the number of meals and snacks per day, mean number for a normal day	Questionnaire results (24th recall or 3 days dietary recall)
Plaque amount	Estimation of hygiene, for example according to Silness-Löe Plaque Index (PI). Crowded teeth leading to difficulties in removing plaque interproximally should be taken into account	Plaque index
Mutans streptococci	Estimation of the levels of mutans streptococci (Streptococcus mutans, Streptococcus sobrinus) in saliva, for example using Strip mutans test	Strip mutans test or other similar test
Fluoride programme	Estimation of the extent of fluoride available in the oral cavity over the coming period of time	Fluoride exposure, interview the patient
Saliva secretion	Estimation of the amount of saliva, for example using paraffin-stimulated secretion and presenting results as ml saliva per minute	Stimulated saliva test — secretion rate
Saliva buffer capacity	Estimation of the capacity of saliva to buffer acids, for example using the Dentobuff test	Dentobuff test or other similar test
Clinical judgement	Opinion of a dental examiner, “clinical feeling”. Examiners have clinical and personal score for the individual patient	Opinion of a dental examiner, “clinical feeling”. A pre-set score of 1 comes automatically

CARIOGRAM: EXPLANATION FOR THE SCORE TO BE ENTERED

Caries experience (caries prevalence)

0 = Caries-free and no fillings. Completely caries-free, no previous fillings, no cavities or M-missing teeth due to caries.

1 = Better than normal. Better than normal — better status than normal, for that age group in that area.

2 = Normal for age group. Normal status for that age group.

3 = Worse than normal.

Worse status than normal for age group, or several new caries-lesions during the past year.

The examiner must have an opinion about the caries prevalence in the country/area where the patient lives to choose the right score. If there is no adequate epidemiological data, you may use the information in the figure on the next page for comparison.

Caries experience (caries prevalence): How to calculate DMF-Teeth? On clinical examination, the number of cavities, fillings and missing teeth should be recorded. The presence of cavities and fillings, the "caries prevalence" is an important factor as it illustrates the balance between resistance factors and caries inducing factors in the past or at present. If the caries prevalence is high, it means that the patient has been susceptible to the disease during the past period of time.

DMFT and DMFS are means to numerically show the caries prevalence and are obtained by calculating the number of Decayed (D), Missing (M) and Filled (F) teeth (T) or surfaces (S).

It is thus used to get an estimation illustrating how much the dentition has become affected by dental caries. Usually, it is calculated on 28 teeth, excluding 18, 28, 38 and 48 from the index.

The older the patient is, the more unsafe is the DMF-T as a picture of the patient caries situation, as several teeth could have been extracted because of reasons other than caries, for example periodontal disease.

A more detailed index is DMF calculated per tooth surface, DMFS. Molars and premolars are considered having 5 surfaces, front teeth 4 surfaces. A surface with both caries and a filling is scored as D. Maximum value for DMFS comes to 128 (third molars are excluded).

Related general diseases

0 = No disease. There are no signs of general diseases of importance related to dental caries. The patient is "healthy".

1 = Disease/conditions, mild degree. A general disease, which can indirectly influence the caries process, or other conditions which can contribute to higher caries risk, e. g. poor eye-sight, inability to move.

2 = Severe degree, long-lasting. Patient could be bed-ridden or may need continous medication for example affecting the saliva secretion.

Several general diseases or conditions can directly or indirectly influence the caries process, either through affecting saliva formation and composition, through a caries-inducing dietary pattern or through medicines. Diseases or conditions in early childhood may have influenced the formation of the enamel. For example:

- autoimmune diseases, like Sjögren's syndrome;
- intake of medicines;
- radiation towards the head-neck region.

Diet, contents

0 = Very low fermentable carbohydrate, extremely “good” diet from the caries point of view. Sugars or other caries-inducing carbohydrates are at a very low level. Lowest lactobacillus class needed to support a zero.

1 = Low fermentable carbohydrate, “non-cariogenic” diet, “non-cariogenic” diet, appropriate diet from a caries perspective. Sugars or other caries inducing carbohydrates are at a low level. Diet, as for an “informed” group.

2 = Moderate fermentable carbohydrate content. Moderate fermentable carbohydrate content. Diet with relatively high content of sugars or other caries inducing carbohydrates.

3 = High fermentable carbohydrate intake. Inappropriate diet from a caries perspective. High intake of sugar or other caries inducing carbohydrates.

Diet plays a key role in the development of dental caries, and a correlation between consumption of fermentable carbohydrates and caries has been demonstrated in several studies, especially where an effective preventive fluoride program is absent. Fermentable carbohydrates include dietary sugars (mainly sucrose, glucose, fructose) and cooked starches, which can be broken down rapidly by salivary amylase to fermentable sugars (glucose, maltose and maltotriose). Thus most eating habits are potentially cariogenic. However, there are different types of artificial sweeteners and sugar substitutes such as cyclamate, asparatame, saccharin and sugar alcohols like sorbitol, xylitol and isomalt that are non-cariogenic.

A good support for diet counselling is the use of saliva tests, like the lactobacillus test. A high lactobacillus count may indicate high carbohydrate consumption. Note that retention areas, open cavities or bad fillings could contribute to a high lactobacillus count. One way of measuring lactobacilli is using the “Dentocult® LB” method. See section “Estimation of lactobacilli in saliva” for more detailed information about the test in the clinic.

Diet, frequency

0 = Maximum three meals per day (including snacks). Very low food intake frequency, maximum three times per 24 hours on average during a long time period.

1 = Maximum five meals per day. Low food intake frequency, maximum five times per 24 hours on average.

2 = Maximum seven meals per day. High food intake frequency, maximum seven times per 24 hours on average.

3 = More than seven meals per day. Very high food intake frequency, on average more than seven times per 24 hour.

Frequency of intake of fermentable carbohydrates is one of the key factors in the estimation of caries risk. Even a small snack — a biscuit or a sweet — contributes to acid production. However, a snack of only sugar-free (“tooth-safe”) products, or water, should not be taken into consideration.

There are several methods available by which a patient can be evaluated. For example: intake frequency questionnaire, the interview method (24th recall)

where you search for a typical dietary pattern in an ordinary day's intake and the dietary record method (usually three days record) where the patient writes down the amount and type of diet for three ordinary days including a weekend day (of course avoiding birthdays and Christmas days!).

Plaque, amount

0 = Extremely good oral hygiene, Plaque Index, PI < 0.4. No plaque, all teeth surfaces are very clean. Very "oral hygiene conscious" patient, uses both tooth brush and inter-dental cleaning.

1 = Good oral hygiene, PI = 0.4–1.0. A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.

2 = Less than good oral hygiene, PI = 1.1–2.0. Moderate accumulation of soft deposits, which can be seen with the naked eye.

3 = Poor oral hygiene, PI > 2.0. Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin. The patient is not interested in cleaning the teeth or has difficulties in cleaning.

Plaque is the direct and important etiological factor for caries (and periodontitis). Different indices could be used to estimate the amount of plaque, for example, to express in per cent how many surfaces are affected. If you are using another criteria other than the Plaque Index used in the table above, then try to convert your scores to a scale of four with "0" for the best score and "3" for the most unfavourable situation. See section "Plaque Index (PI) according to Silness-Löe" for more detailed information.

Mutans streptococci

0 = Strip mutans class 0. Very low or zero amount of mutans streptococci in saliva. Only about 5 % of the tooth surface colonised by the bacteria.

1 = Strip mutans class 1. Low levels of mutans streptococci in saliva. About 20 % of the tooth surfaces colonised by the bacteria.

2 = Strip mutans class 2. High amount of mutans streptococci in saliva. About 60 % of the tooth surfaces colonised by the bacteria.

3= Strip mutans class 3. Very high amounts of mutans streptococci in the saliva. More than 80 % of the tooth surfaces colonised by the bacteria.

Mutans streptococci refer to a group of bacteria, mainly Streptococcus mutans and Streptococcus sobrinus, considered to play a particular active role in the development of caries, especially in the early stages of the lesion formation. They grow on solid surfaces in the mouth, that is teeth or on crowns, bridges or dentures. They have a localised way of growing which means that in one and the same mouth some teeth may carry the bacteria, while others do not. The saliva test indicates how many tooth surfaces that are colonised. Note also that Strip mutans class 0 does not mean that the patient is completely free from this bacterial species.

Mutans streptococci are acidogenic and aciduric meaning that they can produce acids which can dissolve the tooth substance and that they can survive

and even produce acids in a low pH environment. They can also produce extracellular glucans, which helps them to adhere to the tooth surfaces. For section “Estimation of Mutans streptococci in saliva” for more detailed information about the Strip Mutans test.

Fluoride programme

0 = Receives “maximum” fluoride programme. Fluoride toothpaste plus constant use of additional measures — tablets or rinsings and varnishes. A ‘maximum’ fluoride program.

1 = Additional F measures, infrequently. Fluoride toothpaste plus some additional measures — tablets or rinsings and varnishes infrequently.

2 = Fluoride toothpaste only. Fluoride toothpaste only, no supplements.

3 = Avoiding fluorides, no fluoride. Avoiding fluorides, not using fluoride toothpastes or other fluoride measures.

Fluoride is a very strong factor inducing resistance to caries and of importance for remineralisation of early caries lesions. Unfortunately there is no simple test available to estimate the fluorides in the mouth which means that the relevant information on fluorides has to be obtained by patient interviews only.

Saliva secretion — amount

Values for adults are given below:

0 = Normal saliva secretion. Normal saliva secretion, more than 1.1 ml stimulated saliva per minute.

1 = Low, 0.9–1.1 ml stimulated saliva/min. Low, from 0.9 to less than 1.1 ml stimulated saliva per minute.

2 = Low, 0.5–0.9 ml saliva/min. Low, from 0.5 to less than 0.9 ml stimulated saliva per minute.

3= Very low, xerostomia, < 0.5 ml saliva/min. Very low saliva secretion, dry mouth, less than 0.5 ml saliva per minute; problem judged to be long-standing.

Estimation of the saliva flow rate (amount of saliva) can be done in the clinic using simple methods. The patient’s subjective symptoms of a dry mouth, lack of saliva, and saliva volumes are not always correct, and an objective test method is recommended.

If a reduced flow is recorded, one can normally expect that not only the amount but also the quality of the saliva is changed to the worse. Medication, radiation therapy to head and neck that affect the salivary glands, salivary stones, anorexia nervosa, autoimmune diseases and diabetes mellitus are examples of reasons for the low secretion rate. Try to judge if the low secretion rate is of a temporary cause or if it is long-lasting. Choose values from the table above so they represent the saliva secretion rate over a long period of time. In measuring saliva flow rate, one can either choose “unstimulated” or “stimulated” saliva secretion. They are often but not always co-related. If one is uncertain, both types of saliva should be measured.

A detailed description of how to measure stimulated saliva secretion in the clinic is given in section “Estimation of the rate of flow of “stimulated” saliva”.

Saliva buffer capacity

0 = Adequate, Dentobuff blue. Normal or good buffer capacity, Saliva end — pH > 6.0.

1 = Reduced, Dentobuff green. Less than good buffer capacity, Saliva end — pH 4.5–5.5.

2= Low, Dentobuff yellow. Low buffer capacity, Saliva end — pH < 4.0.

The saliva has several important protective functions, both for teeth and for oral mucosal surfaces. In particular, its clearance of food debris, sugars and acids from the oral cavity is important for caries protection. Several buffer systems try to keep pH close to neutral. Buffer capacity is one saliva factor that can be measured.

A simple chairside method called Dentobuff ® Strip can be used to measure the saliva buffering capacity. See section “Evaluation of the saliva buffer capacity” for a more detailed information.

Clinical judgement

Opinion of the dental examiner, “Clinical feeling”.

0 = More positive than what the Cariogram shows based on the scores entered.

The total impression of the caries situation, including social factors, gives a positive view, more positive than what the Cariogram seems to indicate. The examiner would like to make the green sector bigger, i. e. improve the “Chance to avoid caries” for the patient.

1 = Normal setting! Risk according to the other values entered. The total impression of the caries situation, including social factors, gives a view, in line with what the tests and the other factors seem to indicate and points to the same caries risk as in the Cariogram. The examiner does not have any reason to change the program's inbuilt evaluation.

2 = Worse than what the Cariogram shows based on the scores entered. The total impression of the caries situation, including social factors, points in the direction of increased caries risk. Less than good compared to what the tests and the other factors seem to indicate. The examiner would like to make the green sector smaller, which is to reduce the “Chance to avoid caries”.

3 = Very high caries risk, examiner is convinced that caries will develop, irrespective of what the Cariogram shows based on the scores entered. The total impression of the caries situation, including social factors, is very bad. The examiner is very sure that caries will occur the coming year and would want the green sector to be minimal, irrespective of the Cariogram results. The examiner overrules the program's inbuilt estimation.

This factor is different from the other factors. It gives an opportunity for the examiner to express his/her “Clinical feeling”, if the opinion differs from the program's inbuilt estimation.

SALIVA AND BACTERIOLOGICAL TEST METHODS

The tests should be done in the beginning of a treatment session or at a separate occasion and at least an hour after a meal, toothbrushing or smoking. It is important that the patient is relaxed and calm. The patient should not be sick or unfit. The tests should not be done in the middle of a treatment procedure for example after an injection with local anaesthesia or after cavity preparation. The patient should not be on any antibiotics during the past one month.

Estimation of the rate of flow of "stimulated" saliva

Materials needed for the test: Paraffin and measuring cup or glass.

1. The patient should neither eat nor smoke for one hour prior to sampling.
2. The patient should be seated in an upright, relaxed position.
3. A paraffin pellet is given to the patient to chew for 30 seconds, then to spit out the accumulated saliva or swallow it.
4. The patient then continues to chew for five minutes, with the accumulated saliva collected continuously into a measuring glass. Time could be reduced if secretion rate is high, prolonged if rate is low.
5. After 5 minutes, the amount of saliva is measured and the secretion rate calculated. Example: 3.5 ml in 5 min = 0.7 ml/min.

Normal saliva secretion is more than approximately 1 ml/min.

If all the tests are performed at the same occasion, a practical order can be:

- measure secretion rate;
- use some of the collected saliva for buffer capacity;
- Strip mutans test;
- use remaining saliva for lactobacillus test.

Evaluation of the saliva buffer capacity

Dentobuff Strip is a quick and easy way to determine salivary buffering capacity. An indicator system incorporated in the test strip changes colour, clearly showing the buffer capacity of the saliva.

1. Place a Dentobuff test strip, test pad facing up, on an absorbent surface like a paper towel, without touching the test pad.
2. Use the enclosed pipette to apply a drop of stimulated saliva (see estimation of rate of flow of saliva) to the test pad, enough to cover the entire pad.
3. After exactly 5-minute reaction time, compare the colour that has developed on the test pad with the Dentobuff Strip Colour Chart (see fig).

When a drop of collected saliva is added to the test pad of the strip, the saliva starts to dissolve acids which have been dried into the test pad, which also contains pH sensitive dyes. This test system discriminates between low (yellow), medium (green) and high (blue) buffer capacity.

Estimation of Mutans streptococci in saliva

Dentocult SM is used to estimate the Streptococcus mutans count in saliva. The method is based on the use of a selective culture broth and the adherence of mutans streptococci to the test strip.

Method:

1. Take a bacitracin disc from the vial using a forceps or a needle. Do not forget to close the cap tightly back.

2. Put the bacitracin disc into the culture broth vial and let it stand for at least 15 minutes.

3. Give the patient a paraffin pellet to chew for at least one minute. Chewing results in mutans bacteria moving from the tooth surfaces to the saliva.

4. Take one strip mutans test from the container, touching only the square end. Insert 2/3 of the strip into the patient's mouth and rotate it on the surface of the tongue about 10 times. The strip should not be rubbed on the tongue, only wetted well.

5. Remove the Strip mutans from the tongue, pulling it between closed lips in order to remove any excess saliva.

6. Place the Strip mutans in the culture medium. The cap should remain 1/4 open. Hold the vial upright.

7. Fill in the data on the patient label and attach it to the vial.

8. Place the culture vial in an incubator at 35–37 ºC (95–99 ºF) and incubate for 48 hours.

After incubation allow the test strip to dry and evaluate the strip now or later. The strip can be conserved for several years.

The number of mutans streptococci per ml saliva is obtained by comparing the test strip with evaluation chart and classified.

The so-called Strip Mutans test is based on the ability of mutans streptococci to grow on solid surface in combination with a selective broth (high sucrose concentration in combination with bacitracin). As the bacitracin can be added to the broth just before use, the shelf-life of the test can be prolonged considerably. Colony density, CFU/ml, is then counted. Four classes are used for this bacterial test.

Estimation of lactobacilli in saliva

Dentocult LB is a dip-slide method for estimating the salivary lactobacillus count. It consists of a slide with a selective substrate for Lactobacillus.

Method:

1. Let the patient chew on the enclosed paraffin pellet for at least one minute (if saliva is not already collected for secretion rate assessment)

2. Collect the stimulated saliva in the test tube.

3. Remove the nutrient medium from the culture vial without touching the agar surfaces.

4. Pour saliva from the test tube over both agar surfaces, making sure that they are totally wetted.

5. Allow the excess saliva to drip off, then screw the slide tightly back into the culture vial.

6. Write the patient's name and date of sampling on the enclosed label and stick it on the culture vial.

7. Place the culture vial in an upright position in an incubator for four days at 35 ºC/95 ºF.

After incubation — remove the nutrient agar slide from the culture vial after four days. Compare the colony density on the agar surfaces with the densities of the model chart.

Plaque Index (PI) according to Silness–Löe

As a suitable index to estimate the amount of plaque, we have chosen Plaque Index, PI, according to Silness and Löe. PI assesses the amount of plaque in the cervical part of the tooth. Four sites on each tooth are recorded, buccal, lingual and proximal surfaces.

PI 0 = No plaque.

PI 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.

PI 2 = Moderate accumulation of soft deposits within the gingival pocket or on the tooth and gingival margin which can be seen with the naked eye.

PI 3 = Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin

The Index for the four surfaces is summarized and split by 4, which gives an index for the tooth. If the index for all teeth are summarized and split by the number of included teeth, you get the index for the patient. In the original article Silness and Löe used six teeth: 16, 12, 24 and 36, 32, 44.

The measurement could of course include all teeth to give a more representative value. The use of a disclosing solution is recommended to visualise plaque bacteria to the patient, and it also makes it easier to record.

Reference: J. Silness, H. Löe, 1964. Periodontal disease in pregnancy. Acta Odont Scand 22: 121–135.

If you use a % index, for example expressing the % (percentage) of how many tooth surfaces are covered with plaque, you should try to express the values to a scale of four grades. An example:

PI 0 Less than 5 % plaque adhering surfaces.

PI 1 5–20 % plaque adhering surfaces.

PI 2 > 20–50 % plaque adhering surfaces.

PI 3 more than 50 % plaque adhering surfaces.

TREATMENT OF CARIES

STAGE OF WHITE SPOTS

CONVENTIONAL APPROACH

Often, the first approach to eliminating white spot lesions is remineralization. There are several creams, pastes, and topical remineralization treatments on the market (eg, fluoride therapy, casein phosphopeptide-amorphous calcium phosphate pastes), with lots of evidence for varying degrees of success to be found in the dental literature. If these treatment options do not resolve the problem, tooth

whitening may suffice, but will require retreatment in time. More invasive approaches to eliminate white spot lesions in the aesthetic zone include microabrasion, conventional bonding, and the various types of veneers available today.

A NEW MINIMALLY INVASIVE APPROACH

Caries infiltration - micro-invasive treatment of early caries lesions without the need for anesthesia or drilling. The treatment is based on the premise that the establishment of a diffusion barrier within the porous incipient lesion will strengthen, stabilize, and arrest the progression of the lesion while returning the whitish appearance back to the look of sound enamel.

This technique and product, Icon (which is short for “infiltration concept”), was designed to bridge the gap between prevention and restoration, by filling and reinforcing the pore system of a noncavitated white spot, or incipient proximal lesions, with a light-curable resin. The infiltrating resin has a high refractive index and produces a chameleon effect, and requires no shade matching. After infiltration, lesions lose their whitish opaque color and blend reasonably well with surrounding natural tooth structure.

PRINCIPLES OF TOOTH PREPARATION

• To restore function.

• To prevent further spread of an active lesion which is not amenable to preventive measures.

• To preserve pulp vitality.

• To restore aesthetics.

However, these reasons need to be evaluated with regard to the patient and the rest of the dentition. For example, there is little point in attempting restoration of a non-functional.

Preparation design

With caries prevalence declining, emphasis has changed from extension for prevention, to minimizing removal of tooth tissue. Tooth preparation should be based on the morphology of the carious lesion and the requirements of the restorative material being used.

General principles of tooth preparation

• Gain access to caries.

• Remove all caries at ADJ (to prevent spread laterally).

• Cut away all significantly unsupported enamel.

• Extend margins so that they are accessible for instrumentation and cleaning.

• Shape preparation so that remaining tooth tissue and restorative material will be able to withstand functional forces.

• Shape preparation so that restoration will be retained, i. e. undercut for amalgam, none required for resin composite or bonded amalgams.

• Check preparation margins are appropriate for the restorative material. Small areas of unsupported enamel may be left if a resin composite restoration is being placed

• Remove remaining caries unless indirect pulp cap to be carried out.

• Wash and dry preparation.

• While care must be exercised not to overcut a preparation, do not skimp on access so that caries removal is compromised by poor visibility.

• Mark centric stops with articulating paper prior to tooth preparation and try to preserve if possible, or place the preparation margins past the occlusal contact areas.

• Avoid crossing marginal ridges.

• In removing caries a tactile appreciation of the hardness of dentine is important, therefore use slow-speed instruments or excavators.

• The base of the preparation should not be flattened as this runs the risk of pulp exposure.

• Unless caries dictates, margins should be supragingival.

• All internal line angles should be rounded to ⇓ internal stresses. Removing caries with a large diameter round bur automatically produces the desired shape.

• In a proximal box, the margin should extend below the contact point because this is where the caries is!

Amalgam

• Amalgam is brittle, therefore an amalgam cavo-surface margin of at least 70°, preferably 90°, is required to prevent ditching. Also avoid leaving amalgam overlying cavity margins and overcarving.

• Accepted minimal dimensions for amalgam are 2 mm occlusally and 1 mm elsewhere.

• In deep preparations, sealers and/or liners are required to seal the dentine and prevent ingress of bacteria.

• Wear precludes their use in load-bearing situations except for primary teeth, management of root caries, temporary restorations, and the atraumatic restorative technique.

Nomenclature

Black's classification of cavities is now not widely used. It has been replaced by the following:

Occlusal (Class I) Cavity in pits and fissures

Proximal (Class II or III) Cavity in proximal surface(s) of any tooth

Incisal (Class IV) Proximal in an anterior tooth, but including incisal edg

OCCLUSAL (CLASS I)

Amalgam

Amalgam is still the most widely used material for occlusal cavities, probably because it is more reliable of technique than some of the newer materials. It is now widely accepted, however, that resin composite placed in conjunction with minimal preparation techniques has a role in initial lesion management. If enamel margins are cut to an angle of 90° (or, if cusps are steeply inclined, > 70°) the resultant preparation will be adequately retentive.

Lining

Recently, emphasis has changed, with linings being used to seal the underlying dentine for moderate to deep cavities. Light-cured GIs (e. g. Vitrebond) are now recommended. A preparation sealer (Gluma Desensitizer) can be used in minimal preparations.

Resin composite

The technique which has gained more widespread acceptance is as follows: Preventive resin restoration introduced by Simonsen (then by others as the minimal resin composite restoration). Preparation is limited to caries removal and the resultant preparation is restored using fissure sealant alone if small, or resin composite followed by sealant if larger.

Alternatively, GI can be used instead of resin composite. The rationale of this approach is that adjacent fissures are sealed for prevention. It is particularly useful for investigating any suspect areas of a fissure, a technique that is often referred to as an enamel biopsy. This involves exploring the area with a small bur, and if no caries is found further preparation can be aborted and sealant placed. If carious, a PRR can be carried out. It is often possible to complete preparation of a PRR without LA; however, if the cavity appears larger than initially thought, LA can then be given. If the preparation extends significantly into load-bearing areas, conventional tooth preparation should be carried out and the tooth restored with resin composite.

Technique for medium-sized cavities

• Assess whether LA is required. If not, ask the patient to signal if the tooth becomes sensitive.

• Isolate the tooth (preferably with rubber dam).

• Gain access to caries with a small bur at high speed.

• Use a small round bur running at slow speed to remove caries. Only remove as much enamel as required for access.

• Etch preparation margins and occlusal surface. Wash and dry.

• Apply a dentine adhesive system.

• Restore preparation with resin composite placed and cured in increments, but don’t overfill.

• Paint sealant over whole of occlusal surface and cure.

• Check occlusion.

Where possible a related sealant and resin composite should be used to ensure a good bond.

Hints for resin composite restorations

• Use etchant gel in a syringe to aid placement. Many newer adhesive systems do not have a separate etch stage, however, and rely on the use of acidic primers often used in conjunction with bonding resins or as a separate stage.

• Additions are generally easy as new resin composite will bond to old.

• Avoid eugenol-containing cements with resin composite restorations.

• Resin composite must be cured incrementally, with increments being no deeper than 2 mm.

PROXIMAL (CLASS II)

Avoid the creation of an overhang at the cervical margin and ensure a good contact point with adjacent tooth with a well-contoured matrix band and wedges. Amalgam. In practice, preparation size is determined by the size of the carious lesion and extension beyond this should be minimal. Proximal preparations comprise an approximal box with vertical grooves. The preparation should only extend occlusally if there is evidence of caries in the occlusal fissures. Retention from occlusal forces is derived from a 2–5° divergence of the walls towards the fioor in both parts of the preparation. The margins of the box should extend just outside the contact area unless caries dictates a wider position. Amalgam restorations are prone to fracture at the isthmus in restorations extended occlusally, therefore sufficient depth must be provided in this area. The width of the isthmus should not be overcut (ideally 1/4 to 1/5 intercusp width). If the cusps are extensively undermined or missing they should be replaced with a bonded restoration. A chisel can be used to plane away unsupported enamel from the margins of the completed preparation to produce a 90° butt joint. In molar teeth with mesial and distal caries it is preferable to try and cut two separate cavities, but often a confluent MOD preparation is unavoidable. Increasingly the use of resin composite placed in conjunction with a dentine adhesive system is advocated for the restoration of small to moderate proximal preparations in premolar and molar teeth.

Tunnel preparations

A “tunnel” approach to interproximal caries has been described.4 Access to the caries is made through either the occlusal or buccal surfaces, leaving the marginal ridge intact. This approach is only suitable for small lesions, as when preparation is completed, at least 2 mm of marginal ridge must remain. The access cavity may need to be widened buccolingually to complete caries removal. «Carisolv» may have a place here to ensure complete caries removal. A piece of mylar strip wedged into place will act as a matrix. A RMGIC is used to fill the bulk of the preparation and the occlusal access cavity restored with a posterior resin composite. In view of the difficulty of accurately removing all the caries, let alone the incidence of marginal fracture, this technique is rarely used.

Resin composite

Posterior resin composites should be used predominately to restore posterior teeth, but the technique is more demanding, taking ~50 % longer. In addition, it is difficult to establish adequate contact points and occlusal stops. Polymerization shrinkage can cause cuspal flexure, post-operative pain, and marginal gaps. Posterior resin composites are best avoided in the following situations:

- Cusp replacements.
- Poor moisture control.
- Restorations with deep gingival extensions, although a bonded base approach can be adopted.
- Bruxism or heavy occlusion.

If a resin composite is to be used then a hybrid material with > 75 % filler is advisable. Pre-wedging one but not both proximal contacts aids creation of a contact point. Resin composite should be placed, and cured, incrementally. If possible, centric stops should be preserved on sound tooth tissue or the restorative material, but never on the marginal interface of the restoration.

PROXIMAL (CLASS III), INCISAL (CLASS IV), CERVICAL (CLASS V) AND ROOT SURFACE CARIES

Anterior proximal caries

Resin composite is the most widely used material for anterior proximal restorations. Access should be gained from either the buccal or lingual aspect, depending on the position of the lesion. As resin composite is adhesive the preparation is just extended sufficiently to remove all peripheral caries. Some unsupported enamel can be retained labially, but the margins should be planed with chisels to remove any grossly weakened tooth structure. Tooth preparation can be almost entirely completed with slow-speed burs and hand instruments. Ideally the margins are bevelled. A slight excess of material should be moulded into the preparation with a mylar strip, wedged cervically. Once the material is set, the excess can be removed. After checking the occlusion the restoration can be polished using one of the proprietary products (e. g. Soflex discs, Enhance).

Incisal caries

The restoration of choice is resin composite, the so-called “acid-etch tip”; however, for large incisal cavities in adult patient, a dentine-bonded crown or porcelain veneer may give better retention and aesthetics.

Cervical caries

Although cervical cavities are seen less frequently in younger patients, they are an ⇑ problem in older age-groups with gingival recession. Resin composite, compomer, or RMGIC are the preferred materials in this situation. Amalgam should be avoided in this situation due to the possibility of a lichenoid reaction. Once caries has been removed the occlusal margin should be bevelled. The cervical margin should not be bevelled as it has been shown to ⇑ microleakage. The materials are ideally placed incrementally under rubber dam isolation.

Root surface caries

As gingival recession is a prerequisite to root caries, it occurs predominantly in the > 40 age group. Dentine, which has a critical pH below that of enamel, is thus directly exposed to carious attack. It is sometimes seen secondary to ⇓ saliva flow (which reduces buffering capacity and may alter dietary habits) caused by salivary gland disease, drugs, or radiation. Long-term sugar-based medication may also be a factor. Rx requires, first, control of the aetiological factor, and for most patients this involves dietary advice and OHI. Topical fiuoride varnishes and mouthrinses may aid remineralization and prevent new lesions developing. However, active lesions require restoration, typically with a traditional or resin-modified GI cement. See also rampant caries (severe early childhood caries).

MANAGEMENT OF DEEP CARIOUS LESION

Assessment

• Is the tooth restorable and is restoration preferable to extraction?

• Is the tooth symptomless? If not what is the character and duration of the pain?

• Test vitality and percuss the tooth (before LA!).

• Take radiographs to check extent of lesion and if apical pathology.

Management depends upon a guesstimate of pulpal condition. Irreversible pulpitis/necrotic pulp¾Rx: RCT or extraction. Reversible pulpitis/healthy pulp¾aim to maintain pulp vitality by selective removal of carious dentine without pulp exposure. If in doubt Rx as reversible pulpitis. RCT can always be institute later.

Indirect pulp cap

Ideally, tooth preparation should involve the elimination of all caries, but where this would risk pulp exposure and the tooth is vital it may be more prudent to carry out an indirect pulp cap. This involves leaving a small amount of softened (affected but uninfected) dentine at the base of a deep cavity with the aim of arresting further bacterial spread and maintaining pulpal health.

Rationale

• Softening of dentine precedes bacterial invasion.

• Pulpitis does not occur until bacteria are within 0.5–1 mm of the pulp, therefore if a vital tooth is asymptomatic the softened dentine closest to the pulp is unlikely to contain bacteria.

• Prognosis for continuing vitality of healthy pulp is better if exposure is avoided.

• Materials with antibacterial properties help ⇓ bacterial activity.

• Bacteria sealed under a restoration are denied substrate, therefore the lesion is arrested.

Sequence of treatment for vital pulp

1. LA.

2. Apply rubber dam to ⇓ risk of further bacterial contamination.

3. Prepare the tooth, removing caries from ADJ and cut back unsupported enamel.

4. Cautiously remove softened dentine from the bottom floor. If possible complete removal, but if likely to result in exposure and dentine is only slightly softened, stop.

5. Apply hard-setting calcium hydroxide to the bottom floor.

6. Cover with traditional or resin-modified GI cement (Vitrebond).

7. Adjust margins and restore.

8. Warn patient that some sensitivity should be expected initially, but to return if symptoms occur after that.

9. Follow-up for at least 1 yr.

If it is necessary to leave dentine that is probably infected, place hard-setting calcium hydroxide and a traditional GI cement dressing. Leave tooth for 3 months before re-entering to complete caries removal. If the tooth is asymptomatic it would be prudent to cut back the GI cement dressing and place a resin composite restoration as it is likely that the caries has burnt out.

Exposure

• If it is traumatic, small, and uncontaminated, perform direct pulp cap with hard-setting calcium hydroxide and restore.

• If there is carious exposure, and continued pulp vitality is doubtful, RCT will be required. If the time is short, the tooth can be dressed with «Ledermix» and a traditional GI cement, and pulp extirpate at next visit.

Pulpotomy is a removal of coronal part of pulp in order to eliminate damaged or contaminated tissue. It is indicated for teeth with immature apices, as continued vitality of apical pulp will allow root formation to proceed. Once the apex has closed, conventional RCT can be carried out. The pulp is amputated to the cervical constriction, dressed with non-setting or hard-setting calcium hydroxide or MTA (mineral trioxide aggregate) and the tooth is temporarily restored.

Materials used in the management of pulp vitality

Calcium hydroxide has a pH of 11, which makes it bacteriostatic and promotes the formation of a calcific barrier. When calcium hydroxide comes into contact with the pulp a zone of pulpal necrosis is formed. This is subsequently mineralized with calcium ions from the pulp. It is the material of choice for direct pulp caps, particularly the hard-setting type.

Ledermix is a mixture of triamcinolone acetonide (a steroid) and demethylchlortetracycline in a water-soluble base. It has anti-inflammatory and bacteriostatic properties, but also suppresses pulpal defences, therefore resulting in the rapid spread of any bacteria not affected by the antibiotic it contains. It is a useful compromise for the management of irreversibly inflamed pulps where anaesthesia may be a problem, or when pulp extirpation has to be delayed.

SURVIVAL AND FAILURE OF RESTORATIONS

Survival of restorations

The results of Elderton's study into the durability of routine restorations placed in the General Dental Services in Scotland provided both a shock and a stimulus to the professionals, as he found that 50 % lasted for less than 5 yrs. This led to debate over both clinical technique and the professionals' readiness to replace restorations. It has been reported that 60 % of practitioners' time is spent replacing restorations. It is also interesting to note that those patients who change dentists frequently are more at risk of replacement restorations than those who are loyal to the same GDP.

In order to ⇑ longevity we need to consider the reasons for the failure of restorations and diagnosis of secondary caries.

Reasons for failure of restorations

• Incorrect diagnosis and treatment planning; e.g. pulpal pathology; caries of another surface; extraction of tooth for another reason.

• Poor understanding of the occlusion.

• Incorrect preparation; e.g. caries left at ADJ; incorrect margin preparation; inadequate retention; superficial preparation; weakened tooth tissue left unprotected.

• Incorrect choice of restorative material; e. g. inadequate strength or resistance to wear.

• Incorrect manipulation of material, e.g. inadequate moisture control; over- or under-contouring.

Before replacing a failed restoration it is important to identify the cause of failure and decide whether this can be dealt with by replacement or repair. When making this decision bear in mind that cavity size is ⇑ on average by 0.6 mm each time a restoration is removed.

Secondary caries

Unfortunately, placement of a restoration does not confer caries immunity upon a tooth. When caries occurs adjacent to a restoration it is called secondary or recurrent caries. More correctly it is defined as a new lesion which just happens to be adjacent to an existing restoration, and it should be managed in its own right. While secondary caries is an accepted phenomenon, we as professionals have perhaps been a little too ready in the past to diagnose and treat it. Ditched amalgam margins are not a reason for replacement per se, and active intervention is only required if caries can definitely be demonstrated as active. Secondary caries is difficult to diagnose, but careful observation (clinically and radiographically) rather than intervention, is now advocated. Intervention is only indicated when the lesion is in dentine, and there is evidence of progression and/or cavitation is present. To prevent secondary caries it is important not only to educate the patient to reduce their caries rate, but also to examine our restorative technique, to ensure good long term-restorations.

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Учебно-методическое пособие
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