TheDetermination of theindividual caries risk — Prerequisite for customised prophylaxis

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Prophylactic measures can be taken **in a targeted manner if the individual carle risk is known. Differences in the individual carle risk** have **a direct impact** on the type and scope of the **therapeutic** measures **to be** carried out. A practical concept **is presented to** determine **the individual caries risk of a** patient**.**

Introduction

Three years ago, I reported on the prophylaxis concept I used and integrated into everyday practice at the annual meeting of the paediatric dentistry and prophylaxis working group of the German Society of Dentistry, Oral and Maxillofacial Surgery *(Lau- risch* 1986). At that time, we tried to determine the individual caries risk more precisely with the help of prefabricated test materials (Dentocult, DentobuW): In the precise knowledge of the individual caries risk, I saw the possibility of carrying out targeted prophylactic therapy based on the requirements of the individual case.

In the meantime, we have further refined the developed and systematised. Based on the realisation that bacteriological detection methods alone without additional parameters do not have any clear significance, additional criteria for determining individual caries activity are determined and weighted accordingly.

Existing bacteriological test procedures have been further developed or modified. In addition to the diagnostic findings, the microbiological tests we use represent an important detection method for cariogenic bacteria is also an effective didactic aid for patient instruction and patient motivation.

Determination of the Karles risk

We determine the individual caries risk in a confluent diagnosis based on three parameters that have a significant influence on the individual risk. These factors are:

— the previous caries experience,
— the risk of salivary caries,
— the diet-related caries activity.

To ascertain these factors, we developed a medical history questionnaire (see p. 127) which, thanks to its structure, records each of the three parameters individually and assesses them accordingly. The diagnosis of the "individual caries risk" results from the three partial diagnoses, which must be weighted differently for each individual.

The individual risk of tooth decay can then be
The risks can be categorised as low, medium, high and very high.

The caries experience

Previous caries experience is the first parameter to be included in the assessment. It shows what caries activity the patient has been exposed to so far. The DF-T and DF-S indices are determined. An additional factor that is often very important is the pre-carious areas.
(PF) is determined. We define a precarious area as radiographic opacities in the approximal space or clinically visible enamel lesions on smooth surfaces (white spots, chalk stains). By determining the number of teeth of the patient, it is possible to see the DF-T index in relation to this. This provides a value that indicates the percentage of

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Dentist

Name: _____ First name: _____ Date of birth: _____

Date of the 1st examination: _____ Date of examination: _____

1. Findings:

   Type of dentition: M i l k _____ C h a n g e _____ Permanent _____

   oral hygiene on the examination date: _____

   DF-S-Index: _____ DF-T-Index: _____ Number of teeth : _Indax: _____%

   PF-Index: _____ (determined by: B i t e w i n g ___ Clinical _____ Cold light _____

   Previous caries experience : ger1ng medium high very high

2. Saliva analysis:

		Remarks
Streptococcus mutans		
Lactobacilli		
pH value		
Buffer capacity		
Secretion rate		

   Saliva-related caries risk: low medium high very high

3. Nutritional analysis :

   a) Unbalanced diet with a preference for sucrose and starchy products:
   yes / no Remarks : _____

   b) Irregular food intake or many small snacks:
   yes / no Remarks : _____

   c) Consumption of sugary
   yes / no Remarks : _____

   products: d} Consumption of
   yes / no Remarks : _____

   sugary drinks:
   0 to 5 / 6 to 10 / 11 and more

   a) Estimated sugar impu!se per day:

   Diet-related caries activity: low medium high very high

4. Individual caries risk:

   The findings 1 to 3 result in the following individual caries risk: low
   mittel high very high

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9 rophylexe anamnesis sheet to determine the individual caries risk

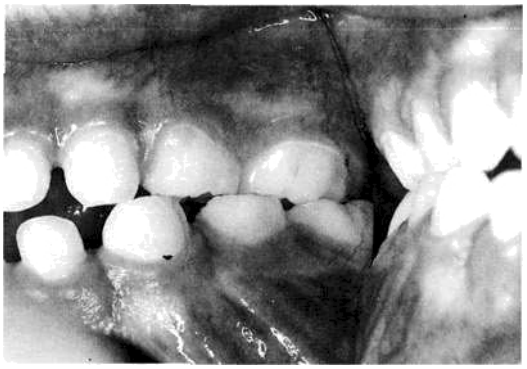


Fig. 1: Typical white discolouration on milk molars approx. 1 mm above the gingival margin. This (occasional) precarious file should not be interpreted as an indication of a high level of har- ias experience,

teeth have already been damaged by Canes. Based on these values, which can be determined in a relatively short period of time, the patient's previous experience with canines can easily be categorised according to the E1nstułung low - medium - high - very high.
A DF-T/tooth count index of over 40⁰ /"is certainly extremely high. A high number of precarious areas may also represent an extremely high caries experience, even if the tooth has not yet been definitively destroyed and thus taken into account in the DF-T or DF-S index. In addition to the clinical findings, the radiograph or a cold light is suitable for determining PFs *(Pieper* and *Schurade* 1987). Pre-carious areas on smooth surfaces are to be assessed differently, especially in children, than pre-carious areas in the proximal space, which should always lead to the assessment of very high caries experience. Children often show whitish discolouration in the sulcus area of the milk morals. These discolourations caused by oral hygiene deficiencies are often remineralised and no longer pose an acute risk (Fig. 1).

The saliva analysis

Several factors come into play when determining the risk of salivary caries:

1. the content of Streptococcus mutans per ml of saliva,
2. the amount of lacfobaziłłes per ml of saliva,
3. the secretion rate of saliva,
4. the pH value of the brine,
5. the buffering capacity of saliva.

1 Determination of the mutans number

Various detection methods have been developed to determine the content of Streptococcus mutans. These methods are not feasible in dental practice as they are generally based on visual assessment of the colony morphology. Only a few dentists will be able to distinguish extracellular polysaccharide formation from non-existent polysaccharide formation. The Dentocult SM+ marketed by Orion a few years ago shows considerable weaknesses in its application, especially in the classification of results *(Laurisch* 1988).
In the Orion test method for mutans streptococci, an undefined amount of saliva is allowed to run over a solid culture medium. After placing two baci- tracin tablets 2 cm apart on the culture medium, the test tube is incubated in an incubator at a constant temperature (37 degrees) for one to two days. The necessary low-acid environment is obtained by placing a carbon dioxide tablet in the test tube. The selectivity of the culture medium for S. mutans can be achieved by placing the bacitracin tablet on top. After incubation, a so-called inhibition zone forms around the tablet. Only mutans streptococci will grow in this halo. The approximate number of streptococci in the saliva can now be determined by comparing the virtual image in the inhibition zone with the original. The following classifications are possible: under 100,000, over 1 million and somewhere in between, whereby there are two grades for this "somewhere in between" (Fig. 2 and 3).
For practitioners, however, this procedure, which at first glance appears simple, proves to be difficult to assess. It is often not móg-

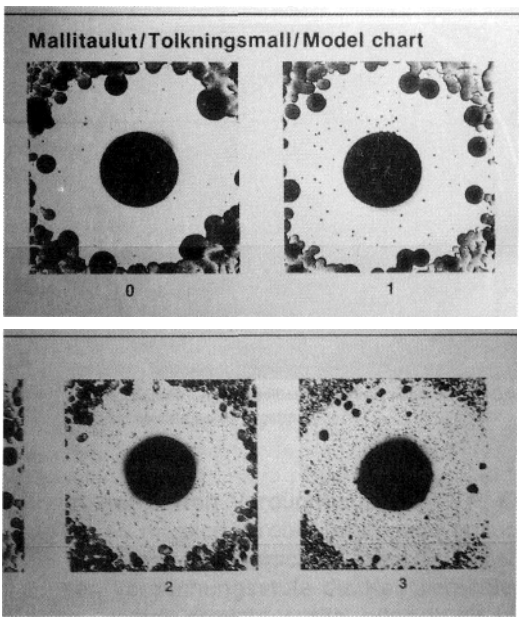


Fig. 2 and 3 : Evaluation pattern of the Dentocult SM system from Orion

It is difficult to make an exact assignment of the colonies in the Hemmhof to the comparison tables. Often the large colonies, which overgrow the entire plate, are impressive, while the often very small colonies, usually also different in size, are very difficult to recognise and thus easily lead to the deception that there is no S. mutans present at all (Fig. 4). This test is unambiguous if there is no formation of an inhibition zone; in this case, macroscopically similar colonies dominate the entire culture medium, making classification easy.

We have been using a detection method developed by me for some time *(Laurisch* 1988). This involves smearing a standardised amount of saliva on a largely selective culture medium (König 1987) in a specific manner. This smearing method is called the so-called 3-eyelet smear.

With the first eyelet stroke (eyelet wide), the total amount (10 microlitres) is spread on the nutrient medium, with the following three strokes this amount of liquid is spread on the nutrient medium.

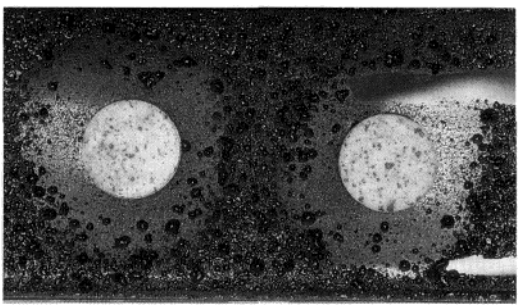


Fig. 4: This patient's test shows the assignment difficulties with the given assignment patterns

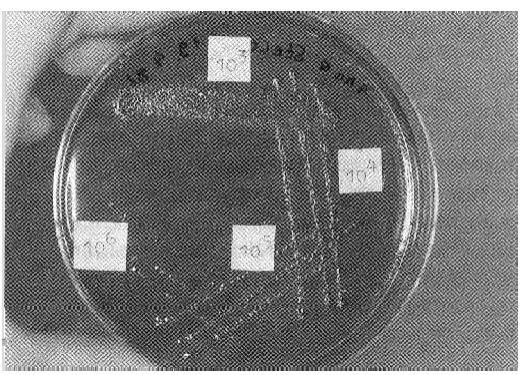


Fig. 5: Allocation of bacterial counts per ml of saliva to the individual dilution levels

further diluted in the culture medium. The eyelet is changed and the strokes are made with the edge of the eyelet. Two of the three strokes are used as control strokes. The amount of liquid initially applied to the plate is thus continuously diluted three times. A special arrangement of the subsequent dilution stages creates the characteristic image of the 3-eyelet stroke.

The carry-over of germs into the next ver-dilution stages is dependent on the bacterial count in the initial smear. The higher the bacterial count here, the greater the probability of bacteria being carried over to the next dilution stage (Fig. 5). If the bacterial growth is limited to the starting line, the bacterial count is 10^3 . If bacteria grow in the first dilution stage, the bacterial count is 10s, in the second 10^s and in the third 10s.

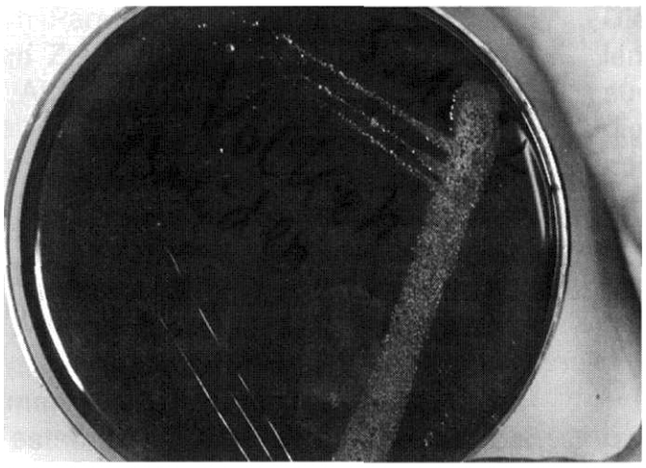


Fig. 6: Evaluation of the same patient according to the 3-axis line shows a clearer result

10° in the third dilution stage. It is also possible to indicate rough tendencies; it makes a difference, for example, whether the germ carry-over has just been reached in the second dilution stage or whether it extends to the end, i.e. almost to the third dilution stage (Fig. 6). The latter indicates a bacterial count of more than 5 times 10^, the former a lower one.

A method presented by *Gehrinp* and *Pi "psr* (1988) measures the total content of acids produced by acid-forming bacteria in a liquid medium. This measurement is visualised by a colour change in the culture medium, which is caused by a special pH indicator (Fig. 7 and 8). This makes it possible to

Lactobacilli or mutans streptococci, not in their numerical size, but in their speed of acid formation, i.e. in their metabolic activity.

We favour the method we have developed for individual prophylaxis, as it offers greater didactic possibilities in the instruction and motivation of the patient. These tests can be photographed and then discussed with the patient. We can also compare them with the initial results at the end of the therapy; this in turn is an additional motivational aid for the patient.

2. Determination of the lactobacilli count

The test procedure described above can also be carried out on a suitable lactobacilli culture medium (Rogosa agar) for this type of bacteria. Classification is considerably easier here than on the test medium from Orion (Dentocult'*), where the test medium has to be visually assigned to prefabricated samples.

3. Determination of the secretion rate

Die Sekretionsrate des Speichels wird bei der Speichelgewinnung bestimmt. Den Speichel gewinnen wir jeweils morgens, bei ungeputzten Zähnen und in nüchternem Zustand. Nach Eliminierung des Ruhespeichels durch das

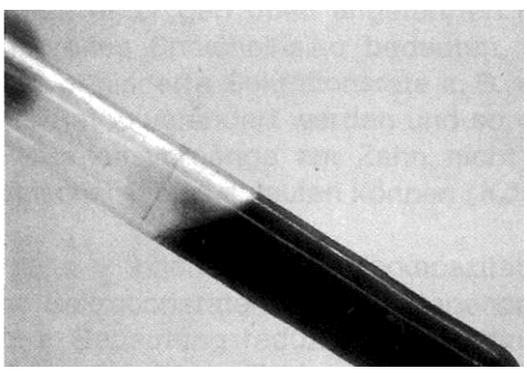


Abb. 7 und 8: Testmedium nach *Gehring* vor und nach dem Farbumschlag

After chewing paraffin for approx. 2 to 3 minutes, saliva is collected over a period of 5 minutes. In any case, 2 ml of saliva should be collected. The quantity obtained, converted per minute, gives the secretion rate. The normal rate is 1 ml, below 0.7 ml the secretion rate is dangerously low.

4. Determination of the pH value and buffer capacity

Prefabricated test strips are available to determine the pH value. The Dentobu test from Orion determines the buffer capacity. This indicates the ability of saliva to buffer acids. Similarly, 3 ml of 0.005 % hydrochloric acid can be mixed with 1 ml of saliva. After 10 minutes, the pH value can be measured. This value gives us information about the buffering capacity of the measured saliva sample \ *Krasse* 1985). The standard value should be between 5 and 7 after 10 minutes; below 5 or above 4.5, a critical value occurs at which normal buffering capacity is no longer present.

Evaluation of the saliva results

The bacterial counts of mutans streptococci and lactobacilli are certainly significant as the cause of caries. S. mutans counts of 10s and lactobacilli counts of 10' indicate an extremely high saliva risk. However, it must be taken into account that the secretion rate of saliva has a not insignificant influence. If the normal secretion rate of 1 ml/min. is significantly undercut, even bacterial counts that are far below those listed above can represent a major saliva risk, as the reduced secretion rate alters the clearance rates, for example, and thus the remineralisation processes on the tooth cannot proceed in a physiological manner *(König* 1987).

On the other hand, good buffer capacities and high secretion rates can reduce the significance of high bacterial counts. However, high S. mutans counts always indicate high sugar consumption, a factor that must be taken into account in the third parameter, the individual nutritional risk.

Bacterial metabolic activity or virulence cannot yet be assessed on the basis of bacteriological examinations, provided that *Gehrinp*'s screening method is not used. However, conclusions can be drawn if all three parameters that have an influence on the individual caries risk have been determined.

The diet-related *caries activity*

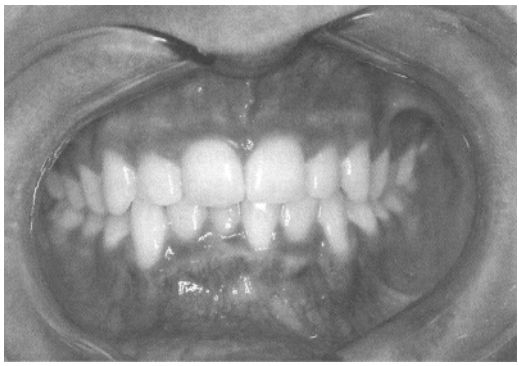
In the four questions on the patient's eating habits, an attempt is made (similar to the OKIN index in functional diagnostics) to determine the number of sugar pulses per day. In children it is certainly not always possible to obtain reliable data, so the number of in-between sugar pulses should be estimated somewhat higher. Sugar impulses above 10 certainly suggest a very high level of diet-related caries activity. Close relationships with the values determined in the saliva analysis often help us further. *For example,* high lactobacilli counts with low S. mutans values can often be caused by the fact that the patient frequently eats bread between meals *[Krasse* 1986).

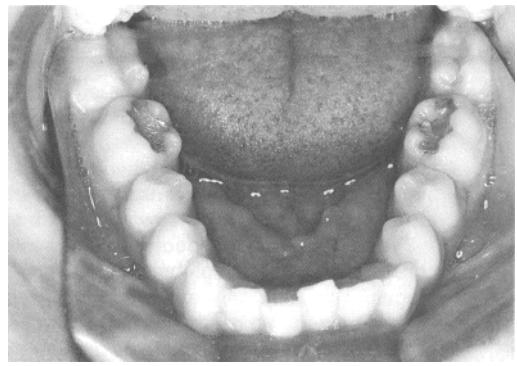
Determination of individual caries activity

We can now determine the current individual caries risk in a confluent diagnosis based on our ana-mnesis, i.e. the caries experience, our saliva analyses (i.e. the saliva-related caries risk) and our nutritional analysis (diet-related caries activity).

All three parameters are included in the diagnosis with different weightings and allow conclusions to be drawn about the virulence or aggressiveness of the bacteria.

If, for example, high caries risk, high saliva risk and high diet-related caries activity come together in a case, it can certainly be assumed that the individual caries activity is very high and that very virulent bacteria are also present. This naturally also has an effect on the prognosis of the case.





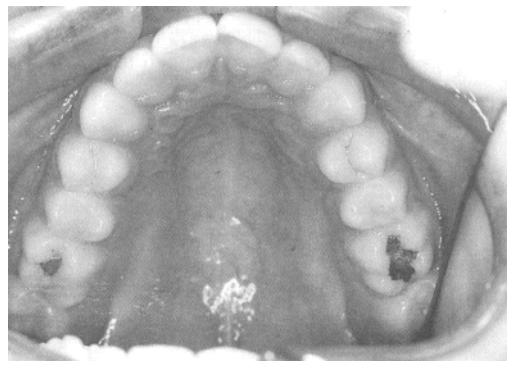


Fig. 9, 10, 11: Typical findings of a high individual caries risk with few fillings, poor saliva values and high diet-related caries activity. The wing bite radiograph already shows five proximal decalcifications (PFs)

On the other hand, a case with little caries experience, unfavourable saliva values and a high nutritional risk can also represent a risk case that requires special treatment, as the patient's nutritional behaviour appears to have changed a long time ago and thus the bacterial saliva risk has also changed over time (Figs. 9 to 11). Conversely, a case that still has a high caries experience as the only risk factor may no longer be a risk case, as the patient's dietary behaviour has changed in the meantime and the bacterial flora of the oral cavity has also changed in favour of non-cariogenic bacteria in the medium term with the change in diet.

It was thus possible to assign each patient an individual caries risk. This means that individualised, patient-specific prophylactic services are possible. Their success can also be monitored, both after completion of the therapy and after one or more years. This also enables us to recognise setbacks, e.g. nutritional changes, in saliva in good time and to initiate treatment together with the patient before a new carious lesion occurs.

Patients with a very high individual caries risk can be recognised and treated more effectively. For example, the use of commercially available fluoride gels is usually not very effective in these patients, as the bacteria are hardly affected by the fluoride concentrations due to their high metabolism. We can immediately start therapeutic treatment with higher dosages (stannous fluoride, prophylactic oral cleaning therapy according to *Axelsson).*

Even if the clinical findings are still good, there may be a high individual risk that can lead to an approximal lesion over time; these cases can be recognised and treated before a definitive lesion develops.

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Summary

Using a practical, statistically analysable prophylaxis anamnesis form, it is possible to

to determine the individual caries risk. This is a prerequisite for dental prophylaxis that meets individual needs.

The caries risk is determined in a confluent diagnostic procedure using three important parameters, which in turn can be assessed differently,

1. the previous caries experience (caries experience) and the precarious areas,
2. a saliva analysis; for this purpose a special The company has developed a new, simple and practical detection method for the detection of lactobacilli and Streptococcus mutans,
3. a nutritional analysis. The aim here is to evaluate the number of sugar pulses per day using standardised questions. This in turn can be used to determine the diet-related caries activity.

The individual caries risk (low, medium, high, very high) can be determined from all three parameters. This also allows conclusions to be drawn about the aggressiveness or acid tolerance of the caries-causing bacteria. This in turn influences the therapy.

Summary

Individual caries risk can be estimated with a statistically analysable prophylaxis anamnesis questionnaire which can be applied in the dental practice. This is a prerequisite for a dental prophylaxis tailored to meet individual needs.

Caries risk was determined by a confluent diagnostics composed of the following three important, variously evaluated, parameters:

1. previous caries experience and precarious surfaces;
2. saliva analysis using a new, simple detection procedure, which can be applied in the general practice and which was developed especially for Lactobacilli and Streptococcus mutans;
3. dietary analysis based on four standardised questions, which evaluates the number of sugar impulses per day and by which diet-related caries activity can be estimated.

The individual caries risk (low, moderate, high, very high) can be evaluated from all three parameters. The findings reflect the aggressivity or acidic toler- ance of the cariogenic bacteria, which, in turn, influ- ences the therapy.

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