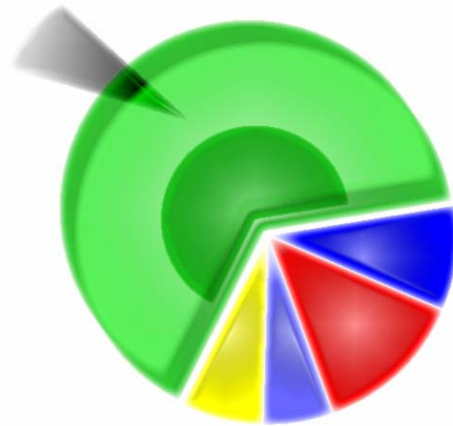


CARIOGRAM

MANUAL

a new and interactive way of illustrating
the interaction of factors contributing
to the development of dental caries



D. Bratthall, G Hänsel Petersson, JR Stjernswärd

Cariogram, Internet Version 2.01.
April 2, 2004

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

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Cover picture: GL Tayanin.

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Preface

The 'Cariogram' is a new concept, conceived initially as an educational model, aiming at illustrating the multifactorial background of dental caries in a simple way. It has gradually evolved over a long period of time until it became a reality, which I now wish to share with the dental profession, students, patients as well as with anyone else interested in this field.

Dental caries is a common, global disease. Although caused directly by bacteria on the teeth, it is generally accepted that a large number of different factors are involved in the process. The interactions of these factors determine if the disease - and cavities - will occur or not. This complex background may be subject for several long and interesting discussions among scientists. Nevertheless, caries has to be explained in a simple, comprehensive way to people and patients, often under time pressure for the dental professionals.

What is a Cariogram? It is a graphical picture illustrating in an interactive way the individual's/patient's risk for developing new caries in the future, simultaneously expressing to what extent different etiological factors of caries affect the caries risk for that particular patient. However, the Cariogram does never specify a particular number of cavities that will or will not occur in the future. It rather illustrates a possible over-all risk scenario, based on what can be expected depending on our interpretation of available information. Cariogram as an interactive PC-program has been developed for educational, preventive and clinical purposes.

The Swedish version of the Cariogram was first launched officially in November 1997 after extensive trials. It has since then been translated into several languages to be used in different countries. It is our belief that the Cariogram, as an educational model, can be generalised. The main principles are "true" also in other societies. On the other hand, the "weights" used for the individual factors may be different in different countries. This means that the user of the program should always be observant to potential unexpected results in relation to his or her own clinical experience. The possibility to use one of the program's factors, the "clinical judgement of the operator" should therefore not be overlooked in this context.

Likewise, the factor, "Caries experience" of the patient in the past, should be related to local epidemiological data. Such data, mentioned in the manual, are examples from Sweden and the UK and values for "normal" thus reflects the situation for a westernised country. If used in countries with a very different caries situation, the local values for "normal" past caries experience should therefore be used.

Professor D. Bratthall developed the concept and the formula for the Cariogram. The PC version was created in collaboration with Dr L. Allander and K-O. Lybegård B.Sc., and the manual was written by D. Bratthall, G. Hänsel Petersson and J.R. Stjernswärd.

This manual explains and gives a guided tour of the Cariogram with additional relevant information on Cariology. I thank all the collaborators, and I wish any user good luck - please look at the Cariogram only as an assistant or a helper - not as your master.

Douglas Bratthall

Introduction

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.

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 programme.

This program cannot replace the personal and professional judgement of caries risk made by the examiner. However, it may give valuable hints and may even serve as a basis for discussions with the patient regarding various risk factors and preventive strategies. In other words, it does not take over the judgement or the responsibilities of the examiner, but may serve as a valuable tool in the clinical decision-making.

Caries risk

Generally speaking, 'risk' is the probability that some harmful event will occur. Risk is often defined as the probability of an 'unwanted' event occurring within a specified period of time. Caries risk is the probability that an individual will develop carious lesions, reaching a given stage of the disease in progression during a specified period of time, conditional that the exposure status for risk factors remains stable during the period in question. Thus, Caries risk relates to the likelihood of a person developing caries lesions or not.

The need for predicting the caries risk accurately is obvious, as targeted preventive actions can be directed to those having a high caries risk, before cavities could develop. Naturally, if the main etiological factors could be

identified, suitable treatment for that particular individual can be carried out with good results.

Which factors are to be considered in the estimation of caries risk?

These factors can be divided into two groups:

- Factors immediately involved in the caries process, either as ‘attack’ or ‘defence’ mechanisms, at the site of the development of the lesion. To this group, on the attack side, the dental plaque, the presence of various specific microorganisms in the plaque (including mutans streptococci) and the diet can be included. On the defence side for example, the salivary protective systems and the fluoride exposure can be incorporated. These are key factors determining if a caries lesion will occur or not, at the specific tooth surface they are interacting.
- Factors related to the occurrence of caries, without actually participating in the development of the lesion. To this group for example various socio-economic factors and past caries experience can be added. Such factors can be designated as indicators of caries risk, but do not participate actually in the ‘making’ of a cavity.

The Cariogram is basically built on the first group of factors (and ‘circumstances’ - yellow sector, see below). This does not mean that the second group is ignored as these factors indirectly contribute to changes in the factors in the first group. For example, poor socio-economic factors can affect both oral hygiene and the diet of an individual negatively.

Factors, to which the tooth surface is directly exposed and which contribute to the development of the caries lesion, are dependent on ‘dose’, ‘frequency’ and ‘duration’. Each factor therefore has to be considered from this point of view. For example, a large amount of plaque (high dose) only indicates high risk if present often (high frequency) and for a longer period of time (long duration).

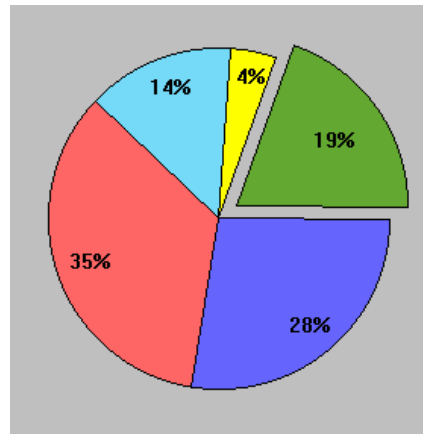
‘Weights’ - the relative impact of factors

The factors included in the Cariogram have been given different ‘weights’. This means that the key factors, which support the development of caries, or resist caries, have a stronger impact than the less important factors when the program calculates the ‘Chance to avoid new cavities’. The factors are also weighted in relation to each other. Thus, different factors have different ‘weights’ in different situations and the number of combinations of factors is enormous.

The given weights are based on thorough search in the literature and evaluation of results in a large number of scientific publications. In addition, clinical experience gained from decades of use of saliva tests has been incorporated. However, it should be understood that there are no actual scientific studies available that have evaluated all the factors at the same time, for different age groups and for different areas. Caries risk evaluations cannot be made with mathematical exactness. For example, it is impossible to say with 100 per cent certainty that "this patient will definitely develop five cavities during the coming year". On the other hand, it is possible to say that "based on available information it seems very likely that this patient will develop several cavities during the coming year – with this combination of caries related factors, cavities usually develop". The Cariogram concept is an attempt to illustrate how a large set of data can be evaluated - based on both science and art!

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 at low risk for 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 expresses *caries* risk only. It does not take into account problems such as fractures of teeth or fillings, discolorations etc that may make new fillings necessary.

What does ‘Chance to avoid caries’ really imply?

The ‘Chance to avoid caries’ (green sector) and caries risk are explanations for the same process but expressed inversely. When the chance is high, the risk is small and vice versa, as shown below.

CARIES RISK	CHANCE TO AVOID CARIES	CARIOGRAM
High risk =	Low chance =	Small green sector
Low risk =	High chance =	Large green sector

Caries risk evaluation can be compared to the weather forecast. To produce an accurate weather report one needs information on several factors such as direction of the wind, wind velocity, temperature, humidity of the atmosphere etc. The meteorologist, when such data are collected and put together, may forecast that, as for a certain area, there was an 80 % risk for strong winds. For the listener this means that the risk for strong wind was high but not absolutely certain. May be the wind will be less strong in some parts of the district.

If the Cariogram shows for example that there was an 80 % chance to avoid caries, taking into account all the factors, it means an over all 80 % chance in avoiding new caries in the future. The caries activity will be low provided the patient does not change his/her behaviour and biological factors on which the judgement was based on. The Cariogram gives the picture for the ‘whole patient’, but locally it may be different, for example nearby an overhanging filling, crown edge or around crowded teeth. Often, it is too time consuming to make a caries risk evaluation for every tooth site.

The program, in a normal case, never shows 0 % or 100 % chance to avoid caries (should the figures appear, it is because of decimal rounding up). Needless to say, the caries risk assessment is complex and one has to be cautious when interpreting.

How to use the Cariogram

Start program

The Cariogram program runs on PC Windows only. The computer should have a colour screen. The Internet Version can be downloaded from this address:

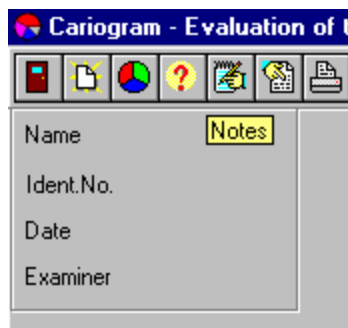
<http://www.db.od.mah.se/car/cariogram/cariograminfo.html>

Follow the instructions given on that page. Then start by clicking the 'Cariogram' symbol.

If the program does not fill up the screen, maximise the program the usual way (you can also double-click on the upper blue line).

Hints - informative text

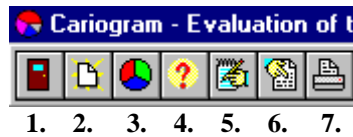
There are several 'hints', informative texts, in the program. Point at the related texts, figures or icons and if there are informative texts behind, they appear after a few seconds, be patient!



You do not have to click for the hint but just point. These hints are very useful, for example, in giving scores for the different factors when building a Cariogram.

Functions

By clicking at the icons in the upper left corner of the screen you get information about the following functions:

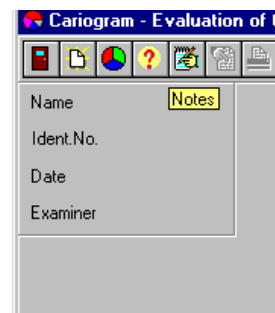
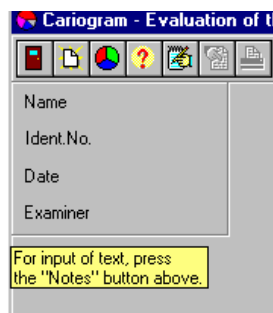


1. Exit - if you want to close the program
2. New - if you want to get a new empty screen (for a new patient)
3. About - to get facts about the program
4. Help - to get more information on how to run the program
5. Notes - to register and write comments on your patient
6. Preliminary interpretation and proposed measures - targeted preventive and clinical actions you could take, based on the scores you entered
7. Print - to print the Cariogram or the recommendations

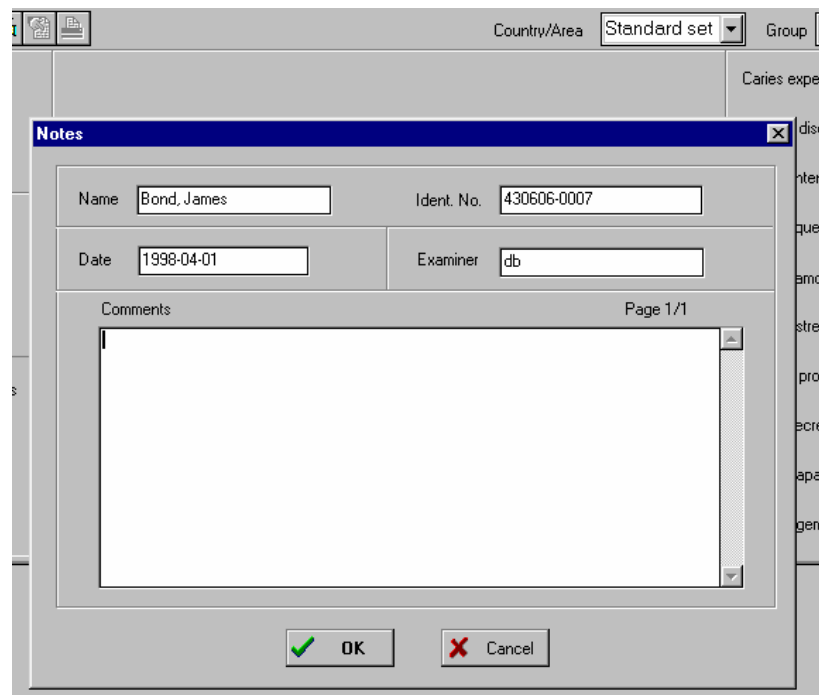
The last two functions do not get activated until a Cariogram appears on the screen.

Identifying (registering) your patient

Also shown in the upper left of the program, just below the icons, are the data needed (name, identification number, date of examination and name of the examiner) to register and identify your patient.



Click open the 'notes' icon above and enter the information for every patient you examine. You can also add your own observations in the space given under 'comments'. This is only necessary if you would like to maintain records of your patients and to avoid mix-up of patient records. Close notes by clicking 'OK'.



Country/Area Standard set Group

Notes

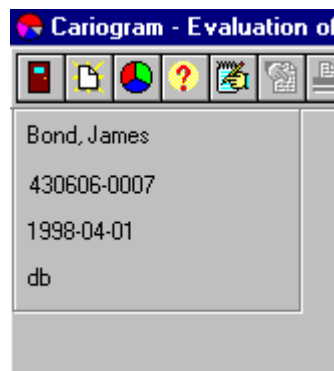
Name Bond, James Ident. No. 430606-0007

Date 1998-04-01 Examiner db

Comments Page 1/1

OK Cancel

The details you just entered on the patient will appear on the upper left corner of the screen as shown below. This information cannot be saved in the program. We suggest you print the patient information and maintain together with patient's records (see 'Save', page 19).



Cariogram - Evaluation of

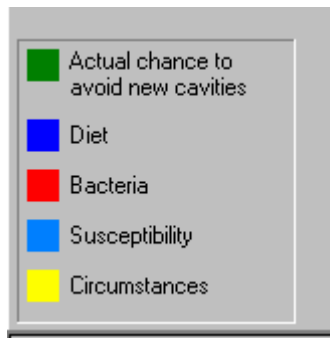
Bond, James
430606-0007
1998-04-01
db

New screen

To get a fresh new screen after entering data for every patient, click the 'New' icon, second, in the upper left corner of the screen.

Colours of the different sectors

To the left, at the bottom of the screen, you will find the different sectors of the Cariogram. Each sector, as mentioned already, has its own colour and represents a group of factors (see Page 8).



- Actual chance to avoid caries
- Diet
- Bacteria
- Susceptibility
- Circumstances

Hints appear if you move the cursor to the coloured squares or to the accompanying text and will give you an explanation as to which factor represents which sector.

Settings for 'Country/Area'

The impact of different caries related factors may differ between different countries/areas depending on several background information. 'Standard set' is most suitable for an industrialised country without water fluoridation.



The examiner may want the Cariogram to continuously express somewhat higher or lower 'Chances to avoid cavities' than the standard set and could choose for *Country/Area* 'Low risk' or 'High risk' accordingly. Thus, the 'Chance to avoid cavities' becomes bigger or smaller respectively, but the relationship between the factors Diet/Bacteria/Susceptibility/Circumstances is not affected.

Settings for 'Group'

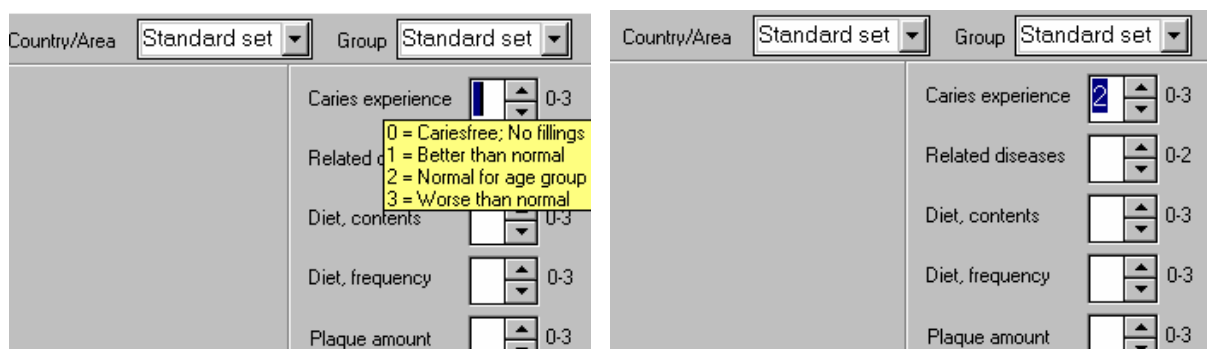
A patient may belong to a 'group' with higher or lower caries risk compared to the general population in the area. Example: Elderly patients with exposed root surfaces have higher risk and the setting 'High risk' is appropriate.



If you use the Cariogram to investigate a special group or a population, pre-set 'Group' to Standard set, Low risk or High risk according to the group you have in mind.

Giving scores for the different factors

To build a Cariogram, scores for the caries related factors are entered in the boxes on the right side of the screen. Again, hints appear when the cursor points at the text or the scores. Move the cursor to the respective ranges 0-3 or 0-2 and choose your score (0, 1, 2, or 3) most suitable for your patient, see page 22 for details on how to score. Click on the 'arrow' to choose the right score (start with upward pointing arrow).



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 definitely appearing during preceding year should score '3' even if number of fillings is low.	DMFT, DMFS, new caries experience in the past one year.
Related general diseases	General disease 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 number of meals and snacks per day, mean for a normal day.	Questionnaire results (24-h 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 levels of mutans streptococci (Streptococcus mutans, Streptococcus sobrinus) in saliva, for example using Strip mutans test.	Strip mutans test or other similar test.

Cont. next page.

Fluoride programme	Estimation of as to what extent fluoride is available in the oral cavity over the coming period of time.	Fluoride exposure, interview the patient.
Saliva secretion	Estimation of amount of saliva, for example using paraffin-stimulated secretion and expressing results as ml saliva per minute.	Stimulated saliva test - secretion rate.
Saliva buffer capacity	Estimation of capacity of saliva to buffer acids, for example using the Dentobuff test.	Dentobuff test or other similar test.
Clinical judgement	Opinion of dental examiner, 'clinical feeling'. Examiners own clinical and personal score for the individual patient.	Opinion of dental examiner, 'clinical feeling'. A pre-set score of 1 comes automatically.

For detailed instructions on how to score for the different components of the colour sectors, see following section: "Cariogram: Explanation to the scores to be entered", page 21.

Estimation of the caries risk. How to build the Cariogram?

In order to see a Cariogram develop in the screen, the examiner must give a score for the different factors, shown in the right hand side of the screen. The examiner has to gather information accurately by talking with and by examining the patient. In certain components of the sectors, like saliva and bacteria, further standard diagnostic test results are needed to give the correct score to build the Cariogram in the screen. The examiner should have all the relevant information when using this program so as to get an accurate Cariogram reflecting the particular patient's caries profile.

Cariogram - Evaluation of the Caries Risk

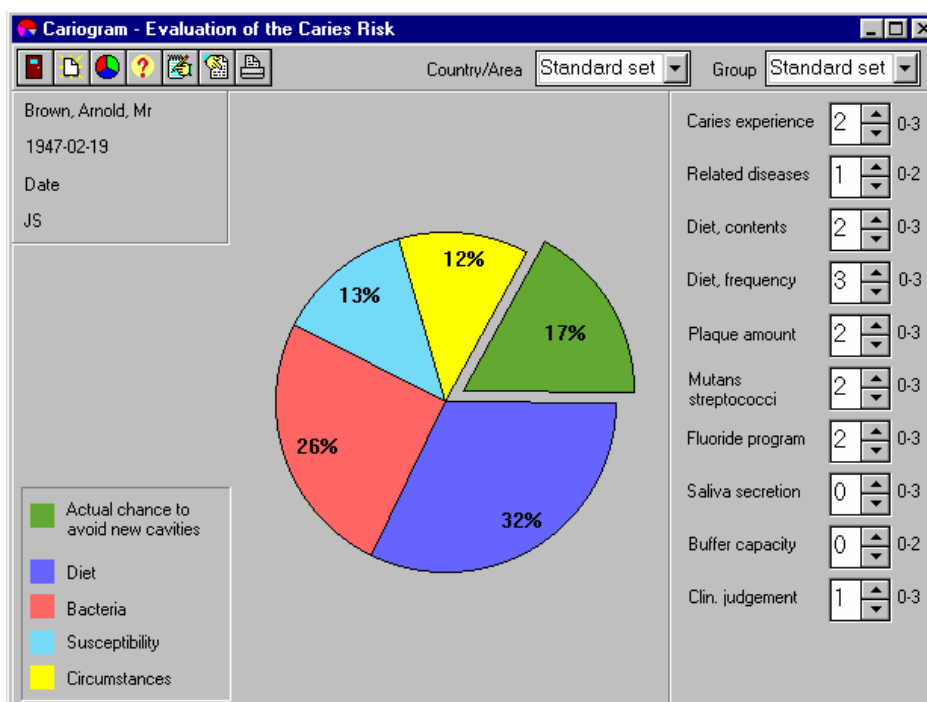
Country/Area: Standard set Group: Standard set

Name: _____
 Ident.No.: _____
 Date: _____
 Examiner: _____

A Cariogram will appear
 HERE
 when at least 7 values
 have been entered in the
 boxes to the right

Actual chance to avoid new cavities
 Diet
 Bacteria
 Susceptibility
 Circumstances

Caries experience: 0-3
 Related diseases: 0-2
 Diet, contents: 0-3
 Diet, frequency: 0-3
 Plaque amount: 0-3
 Mutans streptococci: 0-3
 Fluoride program: 0-3
 Saliva secretion: 0-3
 Buffer capacity: 0-2
 Clin. judgement: 0-3



Enter the relevant scores in the boxes to the right by using ‘up’ or ‘down’ arrows (if no scores in the box, that is if the box is blank, start with ‘up’ arrow). If you wish to check as to what exactly do the scores mean for the appropriate factor, a quick reference is shown when you move the cursor to the respective ranges of 0-3 or 0-2. For all factors, ‘0’ is the best value and ‘3’ (or ‘2’ where 2 is maximum) is the most unfavourable score. A Cariogram will appear in the middle of the

screen when at least 7 scores have been entered in the boxes. There are 10 caries related factors and it is therefore possible to enter 10 scores in this program, but the Cariogram would already appear when only 7 scores have been entered.

The score for the 'Clinical Feeling' will automatically come up as '1', which is the standard. This means that the program estimates the caries risk on basis of the other entered values. Only if the operator finds special reasons to abandon the program's point of view, another score should be entered here, see page 33.

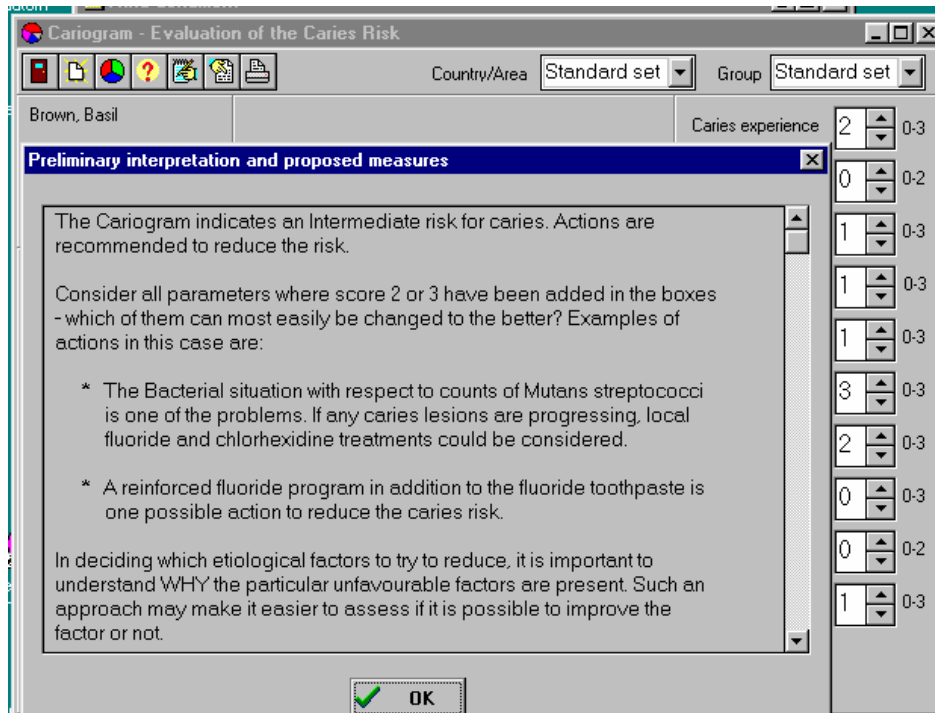
If any score is missing in the boxes, a pre-set value will be used (for the remaining boxes when seven boxes have been filled). Any unfilled box thus makes the program less specific. To obtain reliable and accurate results it is therefore best to enter as many scores as possible instead of depending on pre-set values in the program.

The 'Chance to avoid cavities' - green sector- will appear as a value between 0 and 100 %. It cannot be negative or more than 100%. It is a favourable situation for the patient if the green sector (chance to avoid caries) is large. A green sector of 75% or more would indicate a very good chance to avoid new cavities in the coming year, if conditions are unchanged. A green sector of 25% or less indicates a very high caries risk.

Preliminary interpretation and proposed measures

A set of suggestions for targeted actions in the form of proposed measures can be found if you click on the icon 'Preliminary interpretation' in the upper left corner. It should be understood that these are some suggestions only and do not give a full picture of all possibilities. The responsible examiner must decide if suggested actions, or other actions, are to be carried out or not. Note that the order of the points is not related to their order of importance.

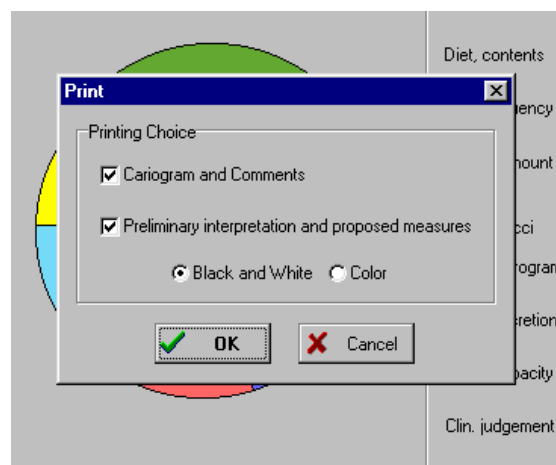
The Cariogram also helps us to illustrate and explain the situation to the patient. For 'high risk' patients discuss which of the factors the patient is willing to change and what measures the dental team could consider. Try to use the Cariogram as an inspiration for the patient to make his/her own efforts. Demonstrate to the patient how the caries risk can be reduced, that is to make the green sector bigger, by just changing scores (to the right) for the different factors.



Print out

The program has a print-out function in black and white and colour. You can choose to print:

- The Cariogram including your own notes
- Preliminary interpretation and proposed measures



When printing, choose if both or only one of the two alternatives should be printed out.

The patient's registration data (if you have entered this) will also be printed on

the preliminary interpretations to avoid mix-up with other patients. Therefore, we suggest adding the patient's name, identification number and date of examination for every patient before printing.

To print in colour, the colour printer must in advance be set as the standard printer (go via "Start").

Although tested in many settings, we can not guarantee that the print-out function will work on all combinations of computers/printers. It is also dependent on the settings of the printer and its graphical capacity. If the PC has a limited memory capacity, it may be necessary to do separate print outs, that is do not mark print out for both Cariogram and Preliminary interpretation at the same time.

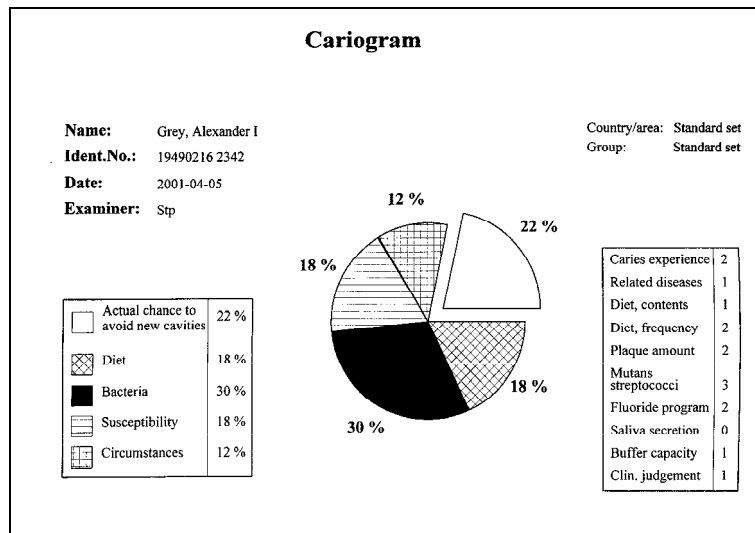
Save

Version 2.01 has no particular 'Save function'. If you want to save any of your comments under 'Notes' in the Cariogram, please copy them to your normal word processor (use the following commands: Mark the text, use Ctrl+c, open page in word processor, insert by Ctrl+v). If you hand over the print out to the patient, it is a good idea to keep a second print out together with your records of the patient. If you do so, remember to enter the patient's name, identification number and date.

There is a way to save a picture of a completed Cariogram in a word processor: When the Cariogram is filling up the screen, press 'Print screen', then press 'Ctrl + c', then open a page in the Word program and paste it into a page with 'Ctrl + v'. Of course, the Cariogram is not interactive in this form. (Recommended commands in this section may not apply to all computers).

Cariogram and Preliminary interpretation; Example.

(The patterns of the sectors in your black and white print-out will look different compared to the sample and are dependent on the individual computer/printer set up).



Preliminary interpretation and proposed measures Grey, Alexander I
19490216 2342
2001-04-05
Stp

The Cariogram indicates a High risk for caries. Some immediate actions are recommended.

Consider all parameters where score 2 or 3 have been added in the boxes - which of them can most easily be changed to the better? Examples of actions in this case are:

- * The Diet situation with respect to frequency of intakes is a clear problem - a reduced number of caries-promoting intakes is recommended.
- * The Bacterial situation with respect to both plaque amount and Mutans streptococci level has a high impact - both factors should be controlled. Improved oral hygiene and repeated professional tooth cleaning is advised. For an effective reduction of the mutans

...etc

Cariogram: Explanation for the scores to be entered

Caries experience (caries prevalence)

Score	Explanation
0 = Cariesfree 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 the last 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 actual 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?

At the clinical examination, 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 how the balance between resistance factors and caries inducing factors has been in the past, or may be at present. If the caries prevalence is high, it means that the patient has been susceptible to the disease during a past period of time.

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

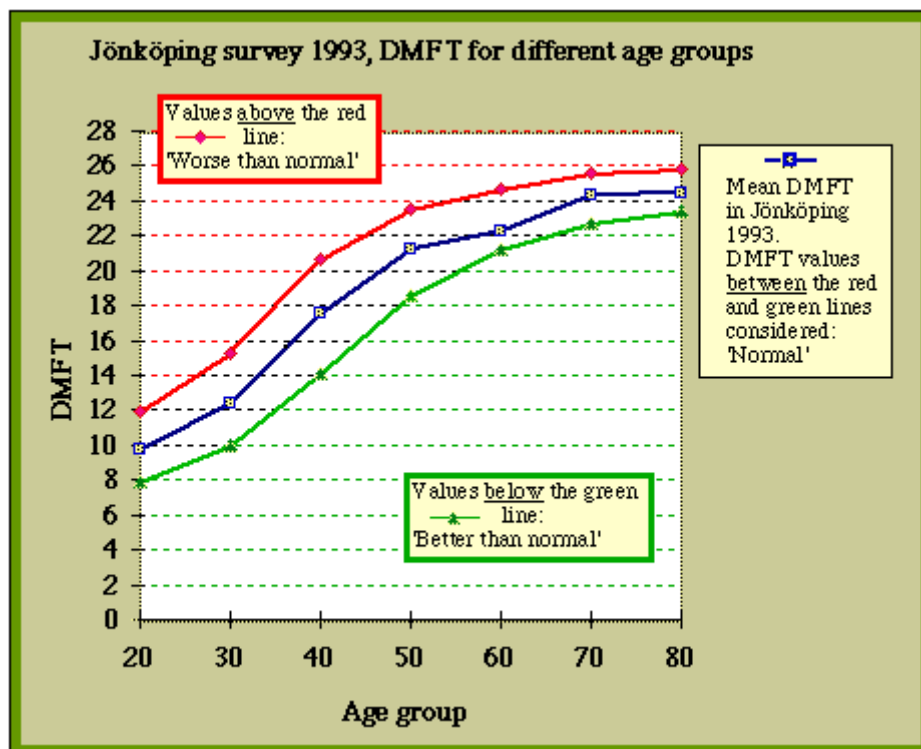
It is thus used to get an estimation illustrating how much the dentition so far has become affected by dental caries. Usually, it is calculated on 28 teeth, excluding 18, 28, 38 and 48 from the index.

The older the patient is, the more unsafe is the DMF-T as a picture of the patients 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 filling is scored as D. Maximum value for DMFS comes to 128 (third molars are excluded).

Reference values

There is actually no "normal" level of caries, as different populations have different caries prevalence. In using the Cariogram, local epidemiological surveys can be used. We present below an example from Sweden and from the UK.



DMFT values for different age groups based on the so called Jönköping's epidemiological survey in 1993.

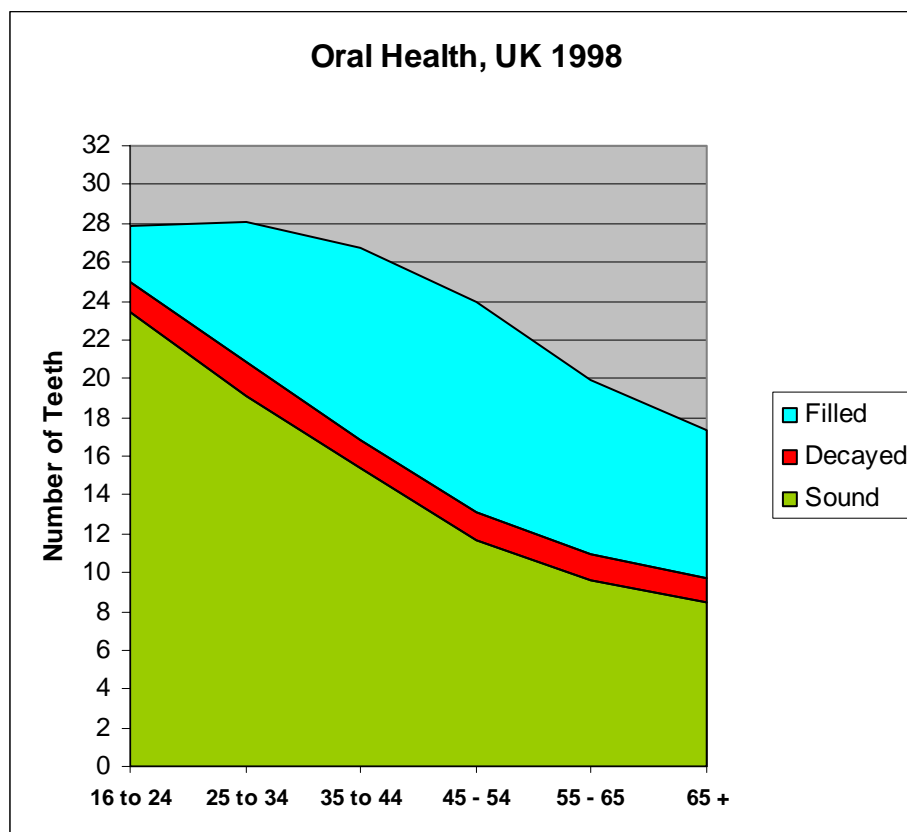
- The blue curve in the middle represents values from the Jönköping, Sweden, survey and represents a mean value for different age groups in that area.
- If the patient has a DMFT value above the upper red curve, it will be classified as 'worse' than 'normal'.
- If the patient has a DMFT below the lower green curve, it will be classified as 'better than normal'.
- DMFT between the green and the red curves will be classified as 'normal'. Observe though, that with the ongoing dental health improvement the area 'normal' will continuously change for the better.

Example: A 30-year-old man with a DMFT = 11 will be as normal for his age

group. A 45-year-old with a DMFT = 13 is 'better than normal'. A 55-year-old with a DMFT = 25 is 'worse than normal'.

The values given in the diagram represent figures for a county surrounding and including a medium size city in the middle of South Sweden. This data is compatible for several Western European countries. However, the DMFT value for the younger age groups such as 20 and 30 maybe less by about 2 DMFT due the improving caries situation seen in the young.

As a further reference, we show the number of sound, decayed and filled teeth for different age groups in the UK.



Reference: Adult Dental Health Survey. Oral Health in the United Kingdom 1998. Office for National Statistics.

Related general diseases

Score	Explanation
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

A more detailed information is given on Internet, see page:
<http://www.db.od.mah.se/car/data/collback.html>

Other problems and handicaps should be taken into consideration. For example, poor eye-sight may affect correct oral hygiene measures. Handicapped patients could have difficulties in cleaning their teeth properly.

Diet, contents

Score	Explanation
0 = Very low fermentable carbohydrate,	Very low fermentable carbohydrate, extremely 'good' diet from the caries point of view. Sugars or other caries-inducing carbohydrates on a very low level. Lowest lactobacillus class needed to support a zero.
1 = Low fermentable carbohydrate, 'non-cariogenic' diet	Low fermentable carbohydrate, 'non-cariogenic' diet, appropriate diet from a caries perspective. Sugars or other caries inducing carbohydrates on 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	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 occasions are potentially cariogenic. However, there are different types of artificial sweeteners and sugar substitutes such as cyclamate, aspartame, 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

Score	Explanation
0 = Maximum three meals per day (including snacks)	Very low diet intake frequency, a maximum of three times per 24 hour as a mean under a longer time period.
1 = Maximum five meals per day	Low diet intake frequency, a maximum of five times per 24 hour, as a mean.
2 = Maximum seven meals per day	High diet intake frequency, a maximum of seven times per 24 hour, as a mean.
3 = More than seven meals per day	Very high diet intake frequency, a mean of 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 (24-h 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

Score	Explanation
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 interdental 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 <i>in situ</i> 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. You feel like cleaning his/her teeth thoroughly, professionally and immediately!

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

Score	Explanation
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

Score	Explanation
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 below for adults

Score	Explanation
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

Score	Explanation
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'.

Score	Explanation
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 on principle 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.

Note: ‘Clinical judgement’ is automatically pre-set to score 1. That value will let the other factors express the ‘chance to avoid new cavities’ according to the program. If you have a reason to believe that the ‘Chances’ are better or worse, change to lower or higher values respectively.

Note: If one wishes to change the ‘clinical feeling’ (not agree to the normal setting) it should be done last. In other words, let the Cariogram build-up from the other factors and then include the score for judgement. Naturally, if there is a valid reason pointing to disagree (better or worse) with the Cariogram result, scoring accurately for the clinical judgement is very relevant.

Reasons that could affect the clinical feeling and motivate for other score than ‘1’ could be the examiners opinion of the patient’s interest for preventive actions, her/his capacity to understand given advice, the examiner’s opinion of the rightness of, for example, the diet situation, judgement of clinical examination or if the test results actually reflect the condition over a long period of time.

The score ‘0’ could be taken into consideration if other preventive actions have been installed which are not expressed in the factors of the program. The score ‘3’ has the greatest input (weight) of all the factors of the program, it means that you actually do not need the Cariogram, because you overrule the judgement of the program.

At the same time, the possibility to use the score ‘3’ shows that the examiner has the final responsibility of the total judgement. The score ‘0’ does not have the corresponding great positive input (weight) because it is not reasonable to believe that the caries risk could be non-existent if several bad factors are present.

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.

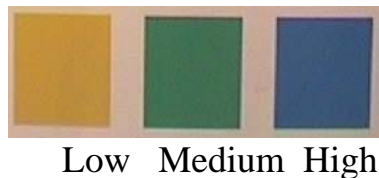
The tests are presented in the following pages in this order.

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, see fig.



Special note: The colour reaction can be uneven or mixed. In that case, evaluate buffer capacity according to the colour indicating the lowest value. If reaction is difficult to interpret, repeat the test.

Estimation of Mutans streptococci in saliva

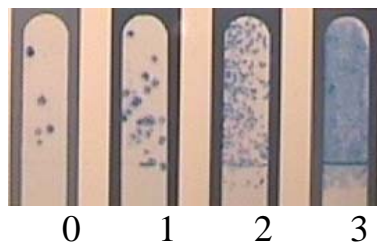
Dentocult SM is used to estimate the *Streptococcus mutans* count in saliva. The method is based on the use of a selective culture broth and the adherence of mutans streptococci to the test strip.

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 °C (95-99 °F) 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, see fig.



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 °C / 95 °F.

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. See fig.

Note: Other microorganism can grow on Dentocult. Often that is not a big problem if the slide is incubated in an incubator. If incubated in room temperature, the risk for growing of yeast-fungus increases.



10³

10⁴

10⁵

10⁶

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: Silness J, Löe H, 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.

For more info about Plaque Indices, see:

<http://www.whocollab.od.mah.se/expl/ohiintrod.html>

Caries risk assessment - 5 case reports

Case 1. Patient B.O. Male, 28 years old, fireman.

The patient is a 28 years old fireman with irregular working-hours. He is fit and takes no medicines. He says that he "always has had many holes (cavities) in his teeth". Clinically, one can see big buccal lesions in the lower jaw. The x-rays show approximal, incipient caries. He uses fluoride toothpaste and brushes his teeth twice a day. Irregular food intake. Smoker.

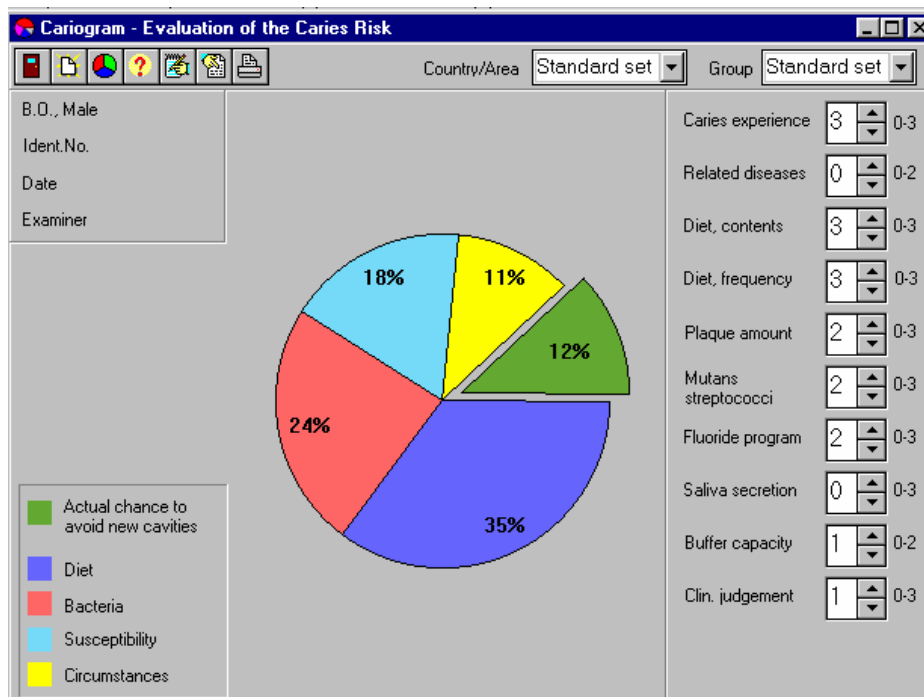
		Score
Caries experience	Many caries lesions. 5 years since last visit to a dentist.	3
Related diseases	The patient is 'healthy', no medical treatment.	0
Diet, contents	Improper diet from a caries perspective. 10 cups of coffee every day with sugar.	3
Diet, frequency	Irregular food intake, snacks often.	3
Bacteria, amount	Brushes twice a day. No interapproximal tooth cleaning. Plaque index 2.	2
Mutans streptococci	Class 2.	2
Fluoride programme	Uses fluoride toothpaste, no other fluoride treatment.	2
Saliva secretion	Normal (2,2 ml/min).	0
Saliva buffer capacity	Reduced buffering capacity (green).	1

Suggestions for preventive and clinical actions - use the Cariogram.

Case 1.



Cariogram picture:



Case 2. Patient J.K. Female, 54 years old, secretary

The patient is a 54 years old woman, and she is working as a secretary. The patient is healthy. The reason for her visit to the dentist is her discoloured teeth in the lower jaw. She has a dental bridge in the upper jaw and root caries in the lower jaw, which seems to be arrested. Eats three meals per day, diet being of 'improper' - caries promoting - composition. Meals in-between consisting of coffee with sugar and a cake. The patient uses fluoride toothpaste and brushes her teeth in the morning and in the evening. No tobacco.

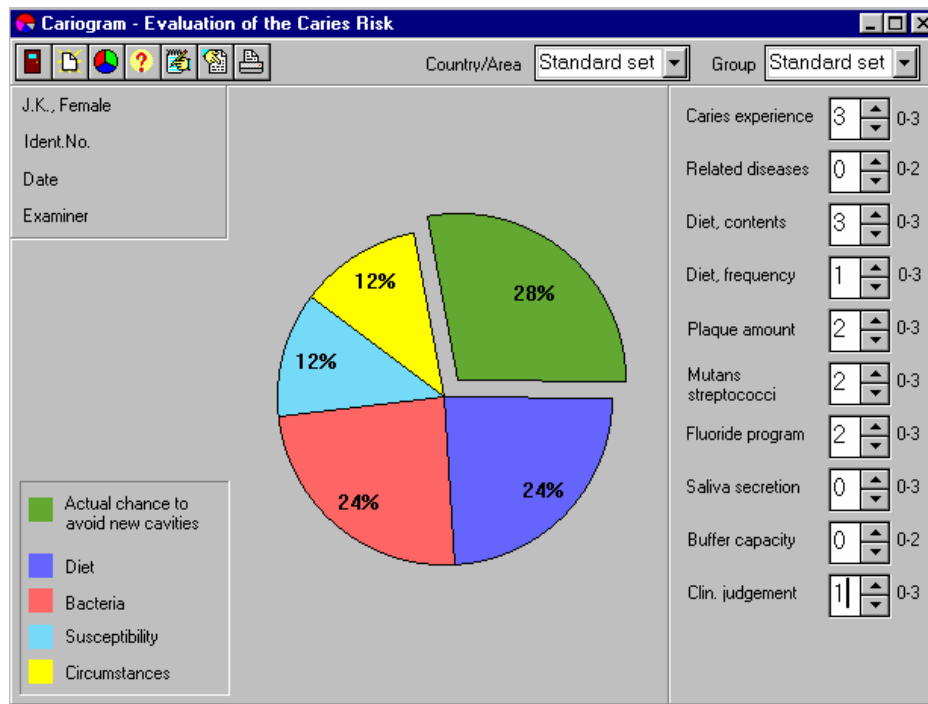
		score
Caries experience	Worse status than normal for the age group.	3
Related diseases	The patient is healthy.	0
Diet, contents	Unsuitable diet from a caries perspective. High sugar intake. High lactobacillus counts.	3
Diet, frequency	Maximum five times per 24 hour as a mean.	1
Bacteria, amount	Less than good oral hygiene. Plaque index 2.	2
Mutans streptococci	Class 2.	2
Fluoride programme	Fluoride toothpaste only.	2
Saliva secretion	Normal saliva secretion.	0
Saliva buffer capacity	Adequate buffering capacity (blue).	0

Suggestions for preventive and clinical actions - use the Cariogram.

Case 2.



Cariogram picture:



Case 3. Patient B.P. Female, 32 years old, teacher

The patient is a 32 years old woman and is a teacher. She is healthy and has a normal status for the age group. The clinical examination shows, however, visible plaque and inflammation of the gums, gingivitis. Less than good oral hygiene. Brushes twice a day and uses fluoride toothpaste. Eats three meals per day and two meals in-between. Food intake with moderate caries inducing capacity. None smoker.

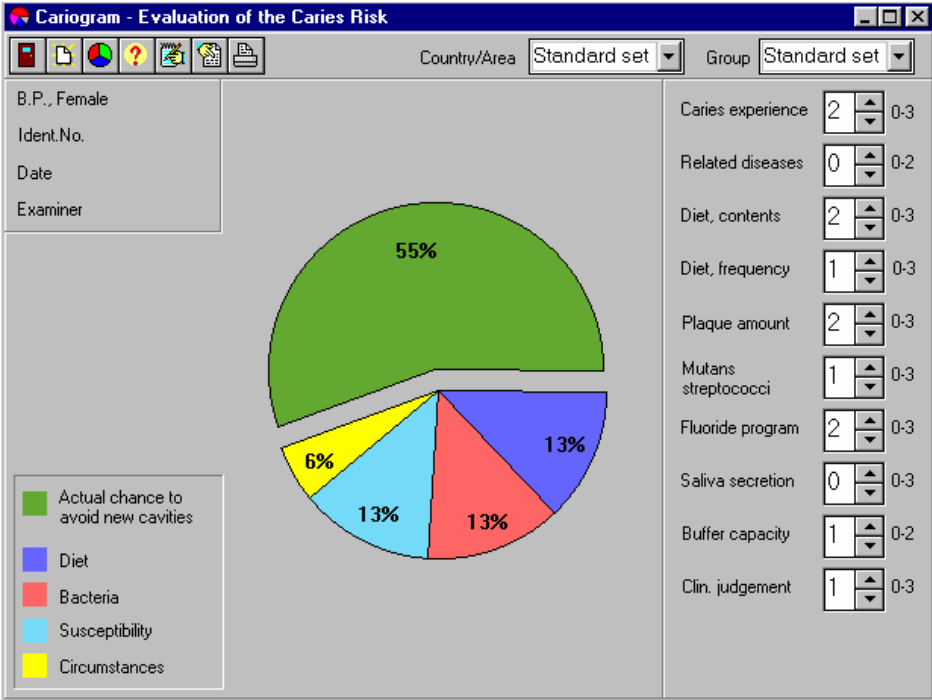
		score
Caries experience	Normal status for the age group.	2
Related diseases	The patient is healthy.	0
Diet, contents	Moderate diet from caries perspective.	2
Diet, frequency	Low diet intake frequency. Maximum five times per day.	1
Bacteria, amount	Less than good oral hygiene. Plaque index 2.	2
Mutans streptococci	Class 1.	1
Fluoride programme	Uses fluoride toothpaste.	2
Saliva secretion	Normal saliva secretion.	0
Saliva buffer capacity	Reduced buffering capacity (green).	1

Suggestions for preventive and clinical actions - use the Cariogram.

Case 3.



Cariogram picture:



Case 4. Patient C M. Male, 74 years old. Retired.

The patient is a 74 years old man and is a retired engineer. He has been treated for periodontal problems. Has a dental bridge in the upper jaw. The patient is healthy but has poor eyesight. He eats three times per day. In-between also takes snacks consisting of coffee and a sandwich. He has stopped smoking.

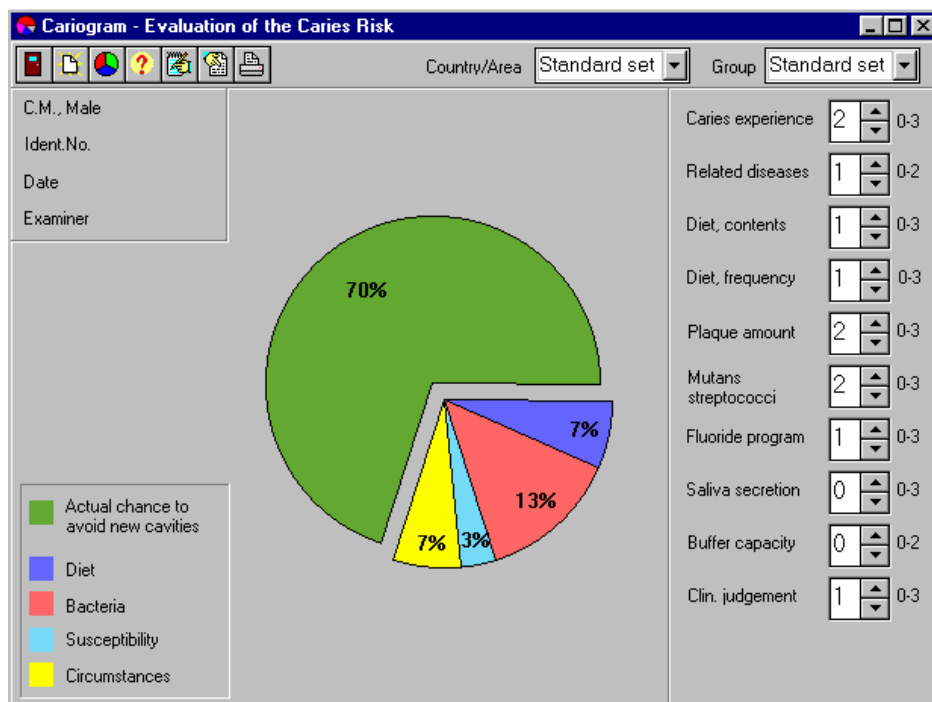
		score
Caries experience	Normal status for the age group	2
Related diseases	Healthy. Poor eyesight.	1
Diet, contents	'Non-cariogenic' diet from a caries perspective.	1
Diet, frequency	1-2 meals in-between. Coffee without sugar.	1
Bacteria, amount	Brushes twice a day. Uses interapproximal cleaning. Plaque index is still 2.	2
Mutans streptococci	Class 2.	2
Fluoride programme	Uses fluoride toothpaste and fluoride tablets every day.	1
Saliva secretion	Normal (1.8 ml/min).	0
Saliva buffer capacity	Adequate buffering capacity (blue).	0

Suggestions for preventive and clinical actions - use the Cariogram.

Case 4.



Cariogram picture:



Case 5. Patient H.U. Female, 22 years old. Student.

The patient is a woman, 22 years old, who likes sports. She visits the dentist on a regular basis. She thinks that her teeth "are yellow", discoloured. Eats three times per day and 1-2 meals in-between. She is well informed about diet. Good oral hygiene, brushes twice a day with fluoride toothpaste and uses dental floss. Chews fluoride chewing-gum.

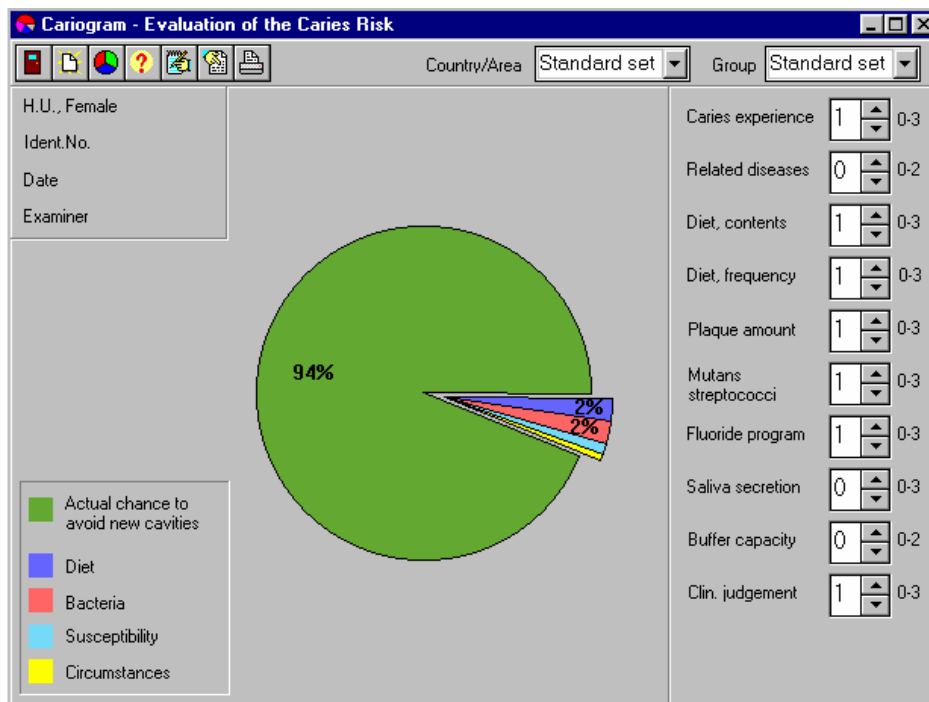
		score
Caries experience	Better status than normal for the age group.	1
Related diseases	Healthy.	0
Diet, contents	Appropriate diet from caries perspective.	1
Diet, frequency	Regular food intake. Low diet intake frequency.	1
Bacteria, amount	Brushes twice a day. Uses dental floss. Plaque index 1.	1
Mutans streptococci	Class 1.	1
Fluoride programme	Uses fluoride toothpaste and occasionally fluoride chewing-gum.	1
Saliva secretion	Normal saliva secretion (2.1 ml/min).	0
Saliva buffer capacity	Adequate buffering capacity (blue).	0

Suggestions for preventive and clinical actions - use the Cariogram.

Case 5.



Cariogram picture:



More information on the Internet

A wealth of information on caries and related factors can be found in the Internet. Here are some addresses for pages produced by the Department of Cariology, Malmö University, Sweden.

<http://www.db.od.mah.se/car/data/basic.html>

- under the title 'Basic Cariology' you will find information on caries diagnosis, risk estimation, prevention, saliva, fluorides and diet.

<http://www.db.od.mah.se/car/data/risk.html>

- presented under the title 'Caries Risk Evaluation' are additional information on the concept of the Cariogram.

<http://www.db.od.mah.se/car/data/mutswitch.html>

<http://www.db.od.mah.se/mutans/mutans.html>

- 'Mutans Streptococci – Dental Caries' gives a detailed picture on the background of these bacteria.

<http://www.db.od.mah.se/lbcm/lbc.html>

- the page 'Lactobacilli – Oral health' illustrates the role of these bacteria in caries.

<http://www.whocollab.od.mah.se/index.html>

- this is the global data base of the WHO, on oral diseases.

Special conditions for use of the Internet Version, see:

<http://www.db.od.mah.se/car/cariogram/cariograminfo.html>

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