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# Practical aspects on rhinostereometry*

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SUMMARY

*Rhinostereometry is an exact optical method used to detect changes in nasal mucosal swelling, where subjects are fixed to a micrometer table by means of a tooth splint, and the nasal mucosa is observed through a surgical microscope. The method is relatively new, used only by a few groups, and needs further specifications for standardised use. In this paper, I discuss the practical use of the method, including pitfalls, from my own experience. Factors like the need to use a tooth splint, the indoor climate, hairs of the vestibulum, psychological influence, anatomical variations, secretion, crusts, subjective interpretation by the observer, and positioning time are important for obtaining consensus recommendations in rhinostereometry studies.*

*Key words: nasal congestion, rhinostereometry, standard, measurements*

## INTRODUCTION

Rhinostereometry is an exact method to detect changes in nasal mucosal swelling, where the nasal mucosa is observed through a surgical microscope in a defined position. Fixation of the subject permits repeated registrations (Juto and Lundberg, 1982). The method is relatively new, and needs further specifications for standardised use.

Standardisation and guidelines for new methods are necessary for the comparison of the results from different studies. Specifications are needed in order to obtain values of accuracy and repeatability for the equipment used. Acoustic rhinometry, a method widely used, was recently reviewed in an ambitious document (Hilberg and Pedersen, 2000).

Rhinostereometry has been used in several studies on rhinitis medicamentosa (Graf et al., 1995; Graf and Juto, 1995; Graf, 1996), and on benzalkonium chloride (Hallén and Graf, 1995; Graf and Hallén, 1996). Reactions to histamine provocations are frequently studied, and a 0.4-mm congestion 5 minutes after histamine 2 mg/ml has been proposed to differentiate hyperreactive subjects from controls (Hallén and Juto, 1993).

Published studies on rhinostereometry originate from an experienced group in Stockholm. Since I have independently used the method, so far only in a very limited number of patients (Ellegård and Karlsson, 1999), (Unpublished data on short-time variation, 2001), I am going to discuss some practical problems that I have encountered.

## METHOD

In rhinostereometry, invented and first described by Juto & Lundberg (Juto and Lundberg, 1982), the subject bites on a tooth splint connected to the frame of the converted eye microscope in order to maintain a stable and repeatable exposure of the nose. The microscope can be moved in three dimensions, and its angle towards the nose can be altered, giving 4 coordinates used to define the registration position for observing the nasal mucosa. As the depth of field is very narrow, the focused area observed at the registration position moves along the mm-scale in the ocular as the thickness of the mucosa changes. I used a Rhinostereometer type S (Rhinomed, Lidingö, Sweden), as recommended by the manufacturer. The coordinates were established with an accuracy of 0.1 mm. Aural examination funnels of appropriate sizes were used to observe the anterior borders of the inferior turbinates. After 30 minutes of acclimatising the subject to the indoor climate, registration positions were selected by choosing focused areas on the anterior edges of both inferior turbinates. Differences from baseline were used for analyses.

## DISCUSSION

The production of the tooth splint is generally no problem, but it excludes patients with loose teeth, bridges, or dentures. Further, if the subject is under dental treatment during a long-term study, this may also result in exclusion. Sensitive persons may feel sick when biting the splint. That was the case with one of my male subjects, who, however, was unaffected when he was allowed to leave the splint between registrations of the right and left side. The plastic for the splint should be softened in simmering water. Care should then be taken not to humidify the examination room, as the optics of the rhinostereometer may get misted over. This may in fact happen anyway due to the weather conditions, as the patient, who can only breathe through the nose when biting the splint, inevitably directs his/her breath towards the optics.

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Hairs of the nasal vestibulum may impair a clear view of the inferior turbinate. The necessary trimming should not be done immediately before registrations, as it may influence nasal swelling.

As the changes in mucosal swelling are seen clearly by the observer, I have noted that even small events may upset the nasal mucosa although the patient is not aware of it. My first experience of this was when my male colleague very quietly entered the room: the inferior turbinate of my female patient almost disappeared. A non-enter sign on the door is therefore mandatory. Even a simple comment may upset the nose. When I worked on the design of a study on short-time variation, I made registrations every other minute on my nurse. We had planned to register for 15 minutes, and when we had spent those I just said: "We will continue for another 15 minutes, is that OK ?" It was no problem, and while she denied agitation or stress, it was obvious that her nose reacted (Figure 1). Therefore only trivial conversation, if any, should be allowed.

At times, the mucosa may be seen "drifting", and it may be necessary to "shoot on a moving goal". It is important to define the focused area at the time intended. If time is not important, you may of course wait, but, as I found in a study on short-time variation, it may not stabilise even after 30 minutes waiting (unpublished data, 2001).

Large variations may produce problems, as the focused area can "hide around the corner": the position initially selected does not allow registrations when the mucosa is maximally congested or decongested. In cases with septal deviation, congestion is the problem, and in narrow vestibuli, decongestion. Care must be taken not to disturb the anatomy, or hurt the mucosa in the anterior part of the nose, when trying to find the focused area. The mucosa on the anterior part of the inferior turbinate may move when the vestibulum is manipulated with the speculum.

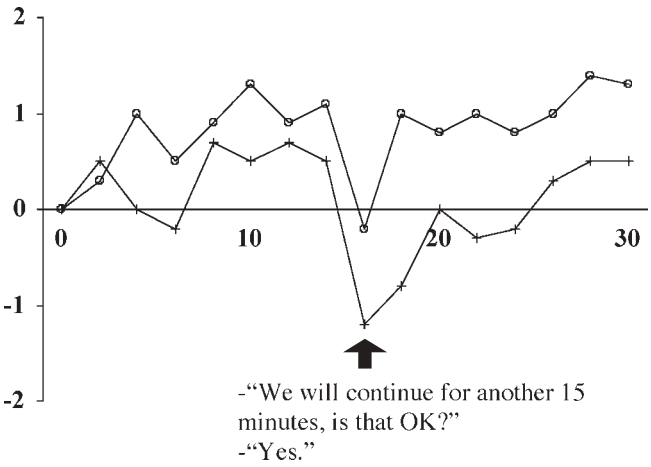


Figure 1. Bilateral registration from my study nurse, whose nose reacted to a simple question. On the vertical axis is set the difference from the baseline in mm and on the horizontal axis the time in minutes.

Nasal mucosal secretion can be studied beautifully in the rhinostereometer. However, it disturbs the measurements, as it prevents finding the focused area of the underlying mucosa. The same disturbances can occur with crusts, which of course have to be disposed of before measurements can start.

Registrations are in one aspect subjective, as the readings on the millimeter scale are made by the observer. It is sometimes difficult to define the border of the focused area, and even in easy cases, subconscious wishes towards results may exist. The participation of multiple examiners introduces other complications. Therefore blinded registrations are absolutely necessary.

Doubts of where to define the border of the focused area may take some time, but positioning the apparatus to the 4 coordinates takes most of the time. It is sometimes possible to have the vertical coordinate identical for both nostrils, which makes positioning quicker. In the study on short-time variation, the time required for bilateral registrations varied greatly, and it did indeed take more than a few seconds to perform a bilateral registration (unpublished data, 2001). However, in no case did I exceed the maximum time of 2 minutes set by Juto in his 4-hour study (Juto and Lundberg, 1984).

Rhinostereometry is an important tool, which can be used to measure small changes in nasal mucosal swelling with great accuracy. Practical handling of the apparatus needs to be standardised, and pitfalls to be highlighted. My experiences, after some 1000 registrations, are presented above. As the method is relatively complicated, and time-consuming compared with e.g. acoustic rhinometry, the future of rhinostereometry may be in standardised provocation studies with histamine or allergens, and in other specialised applications such as laser Doppler.

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