Surgical orientation during balloon sinoplasty in children

Introduction
The defined location at which the surgeon performs an operation is a fundamental condition for ensuring safety of such procedures. The nasal sinus is such a surgical area fraught with difficulty when operating. The specific conditions of a child’s anatomy pose additional challenges. Although the balloon sinuplasty technique is a minimally invasive surgical technique, its safety depends on precisely positioning the required surgical instruments within the operating field. Methods for surgical orientation/navigation during balloon sinuplasty include X-ray imaging, sinus transillumination, and intraoperative navigation.

Study aim
To investigate the different ways of intraoperative navigation when performing balloon sinuplasty in children.

Methods and Materials
We investigated 75 balloon sinuplasty operations performed on child subjects, which in 65 cases used sinus highlighting as a means of navigation whilst 10 cases used intraoperative navigation. The orientation with respect to external structures was examined such as the tip of the nose, the corner of the eye inside the nose, as well as the middle turbinate margin and the location of the probe within the sinus. The literature on intraoperative orientation was also analysed.

Results
A measurement error not exceeding 0.5mm was found in localising the outside and the inside of the nasal structures in patients having their sinuses highlighted, as likewise in those where intraoperative navigation was used. The end of the probe inside the sinus in the group using highlighting was used only for indicative purposes. However, in those where intraoperative navigation was used, the position of the probe within the sinuses was precisely determined for balloon navigation.

Discussion
Endoscopic navigation is important when conducting endoscopic surgery which includes balloon sinuplasty. In our subjects, we employed sinus highlighting which is used mainly in the superficial (maxillary and frontal) sinuses; this being much less effective for the wedge sinus or in midoperative navigation for which balloons are used as a standard tool introduced for navigation purposes. Navigation allows spatial orientation in three planes. Both methods gave favourable operational orientation in our subjects. It is also possible to use X-ray imaging to determine surgical instrument positioning, which requires delivering additional doses of X-rays to the patient.

Conclusions
Using intraoperative navigation to locate the position of the surgical instruments used in sinuplasty as standard navigational tools allows a high intraoperative accuracy to be obtained.

The use of sinus highlighting is of comparable efficacy to navigation, but this chiefly applies to the maxillary and frontal sinuses.

X-ray imaging is acceptable for use in achieving appropriate intraoperative navigation in children.