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Authors' reply

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Authors' reply

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Dear Editors,

We are pleased to have the opportunity to comment on the Letter to the Editor regarding our paper entitled 'Effect of surgery, delivery device and head position on sinus irrigant penetration in a cadaver model'.[1] We read the letter with interest, and we are grateful for the interesting comments and the chance to discuss some of our work in more detail.

In our study, we used direct intra-sinus endoscopic visualisation to analyse the combined effect of head position, extent of surgery and delivery device on the distribution of topical irrigation into the paranasal sinuses. To our knowledge, this is the first report analysing these three factors at the same time.

Regarding head positions, our study evaluated the 'nose-to-sink' (nose facing 45 degrees downward) and the 'vertex down' (nose facing 90 degrees downward) positions. We found that head position significantly affects frontal sinus irrigation (which improved in the vertex down position), while it did not influence irrigant distribution within the maxillary and sphenoid sinuses. Craig *et al*.[2] used a computational fluid dynamics model to compare the irrigant penetration according to different head positions and found that sphenoid sinus irrigation was increased using the 'nose-to-ceiling' (nose facing 90 degrees upward) position because of the effect of gravity. These data are difficult to compare, because in our study we focused only on the positions more frequently recommended by the commercial products for nasal irrigation currently available. However, as several authors agree on the significant effect of head position on the irrigant penetration,[1–4] it is possible that in the clinical practice additional head positions might be suggested in order to assure the best possible mechanical lavage and medication delivery to specific sinuses (for example, nose-to-ceiling for the sphenoid and vertex down for the frontal sinus).

It must be noted that, even if both the nose-to-sink and vertex down positions tested in our study require irrigation against gravity, a satisfactory irrigation of the sphenoid sinus was obtained using the squeeze bottle (from 'trickle through the ostia' for step one of surgery to 'free flow' for step three of surgery, according to the scale we used to evaluate the amount of irrigant entering each sinus), while the gravity dependent device and the syringe assured less effective results. We consequently agree with the authors of the Letter to the Editor that if the delivery device provides a volume of irrigant sufficiently large enough to fill the nasal cavity, and a pressure able to propel the irrigant into the paranasal sinuses, then head positioning would be a secondary consideration.

In our study, a positive effect of surgery was demonstrated for the frontal sinus, even if no significant differences between Draf IIa and Draf III procedures were found. This finding suggests that the Draf III procedure does not assure a significant increase of irrigant distribution within the sinus. We hypothesised that this phenomenon might be related to the removal of the upper portion of the nasal septum, which shunts the flow of solution before it reaches the sinus. This hypothesis is in line with the findings of Zhao *et al*.[5] These authors used computational fluid dynamics to evaluate the impact of septal removal during Draf III procedures, and reported a premature spillage of the irrigant across the resected septum, with a consequent reduction of frontal penetration. However, Barham *et al*.[6] demonstrated that the Draf III procedure was superior to the Draf IIa procedure for topical irrigation of the frontal sinus. It is possible that these diverging results are related to the small number of cadaver heads included for the analysis. Further studies are consequently needed in order to better understand the role of surgery in irrigant distribution within the frontal sinus.

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