

Reply to

“Artifacts in 3D rendering: Secondary palate concealed in acoustic shadow and the use of edge detection filters”

Andrea Dall'Asta^{1,2}, Gowrishankar Paramasivam¹, Christoph Lees^{1,3,4}

1Centre for Fetal Care, Queen Charlotte's and Chelsea Hospital, Imperial College Healthcare NHS Trust, London, UK

2Department of Medicine and Surgery, Obstetrics and Gynecology Unit, University of Parma, Parma, Italy

3Department of Surgery and Cancer, Imperial College London, London, UK

4Department of Development and Regeneration, KU Leuven, Leuven, Belgium

**Correspondence.*

(e-mail: christoph.lees@nhs.net)

We thank Drs Tutschek and Blaas for their continued interest in our work (1) and its related correspondence (2-6). If set aside the rendered views in Figures 2a and 2b from our original manuscript (1), in our previous replies (2,3) we addressed their criticisms of shadowing directly (4): the multiplanar view clearly shows the presence of true voxels (see Figure 1c) (2,3) in the volume presented. Hence the secondary palate is identifiable and cannot be confused with any other structure.

The additional issues raised by the Authors are now addressed as follows:

1. There is a misunderstanding on the issue of shadowing. Drs Tutschek and Blaas (6) refer to our sentence (3) “the concept of shadowing in this context is not related to the mode of acquisition of the volume, but instead to post-processing and rendering”, referring to shadowing caused by image acquisition (3-6). This is quite different to the “shadowing” first described in a study on 3D imaging of the fetal palate which was overcome by turning the volume 180° around the ‘y’ axis (the ‘reverse face’ view) (7). So it is clear that shadowing can be used to describe the apparent or true loss of imaging data related both to acquisition, and post processing and rendering. In order to avoid any further misunderstanding, the rendered view showing true voxels of the secondary palate and presented in our replies (Figure 1) (2,3) is the same which was used to obtain the rendered views shown in our original manuscript (1). For the record, we do of course agree with Drs Tutschek and Blaas that the acquisition modality impacts on shadowing and 3D rendering artifacts.

Drs Tutschek and Blaas are correct in commenting that the label in our original Figure 2b is “erroneously placed on other “reconstructed” supra-palatal structures”, however they are wrong to conclude that their Figure 1b (6), which we report as Figure 2a, corresponds to our Figure 2b (1). They argue that the structures we refer to are far too high: we disagree as the palate is a thick structure (see Figure 1a and 1b) whose integrity may be evaluated not only in its lower border but throughout its thickness. Another substantial difference between our Figure 2a and 2b is the attitude of the fetal mouth, which in our case is open and contains amniotic fluid (1) while in the case presented by Drs Tutschek and Blaas is closed (6) (Figures 2a and 2b, arrows). This may have lead Drs Tutschek and Blaas to conclude that “the red reference dot lies far too high”, which is not the case as the original multiplanar view shows that true voxels on the secondary palate are present (See Figure

1c). In Figure 2 we detail our interpretation of the sagittal multiplanar view presented as Figure 1c irrespective of the labeling Drs Tutschek and Blaas displayed in their Figure 1c-III (6); in Figure 3 we show a labelled midsagittal view of our index volume in which we demonstrate the absence of shadowing inside the fetal mouth and the minimal shadowing at the level of the lower portion of the midpalate.

2. As shown in Figure 4, the fetal palate is a thick structure and is not flat in either sagittal or transverse sections-it is rather 'domed', which is why we cannot agree that "the fetal secondary (hard) palate at mid-gestation is relatively flat in an (ultrasound) axial plane" as stated by Drs Tutschek and Blaas. Their source in fact states that it is 'slightly bent' (8). How slightly bent must it be to be flat and vice versa? This is why we do not believe the palate cannot be imaged and its integrity confirmed according only to the principles of Drs Tutschek and Blaas, who in any event cannot claim sole ownership of the concepts of palatal imaging.
3. In our manuscript (1) we evaluated how Crystal Vue performs in the evaluation of palatal imaging. The properties of Crystal Vue are not unique and we do not accept that mimicking this technique using proprietary software as Drs Tutschek and Blaas have done is a true reflection of Crystal Vue. We agree that Crystal Vue, as with any other technique, needs prospective validation before clinical application, hence our readiness to publish our findings openly and engage in discourse. No 3D technique has to our knowledge yet undergone validation.

We hope that Drs Tutschek and Blaas will constructively engage with us in finding agreement as to how to image the fetal palate, so that practitioners may be confident on its integrity and how to accurately evaluate the extension of palatal defects. This is, as yet, far off despite a profusion of papers on the subject by our respective groups and many highly respected experts.

REFERENCES

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Figure 1 – Multiplanar view of the index volume: coronal plane (a) and sagittal plane (b), showing secondary palate with midpalate shadowing (arrow); (c) axial plane, showing secondary palate (arrows) along with interpalatal fissure (*).

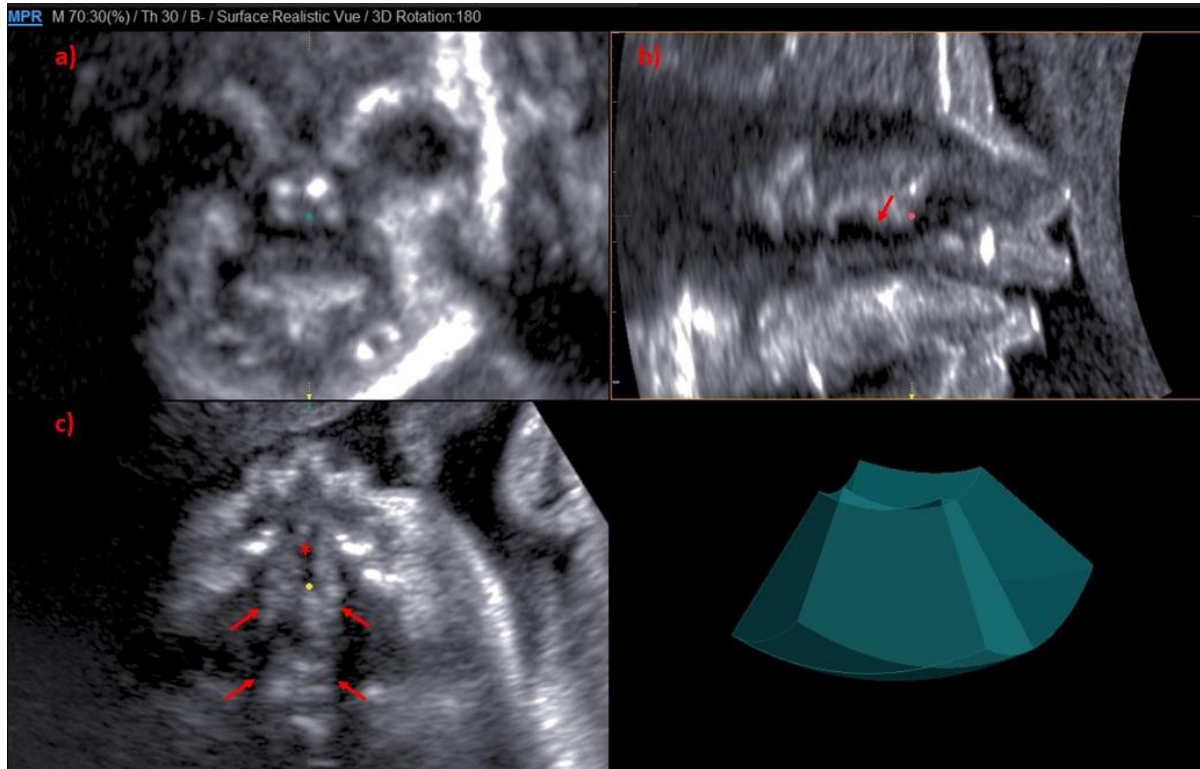


Figure 2 – Midsagittal rendered views of fetuses showing different attitude of the fetal mouth. As highlighted by the arrows pointing the upper and the lower alveolar ridges and the * pointing the tongue, in Figure 2a the mouth is closed while in Figure 2b the mouth is open as the tongue lies in between the alveolar ridges, which implies the presence of amniotic fluid in the fetal mouth. This may lead to the false impression that “the red reference dot lies far too high”, which cannot be the case as the original multiplanar view shows that true voxels on the secondary palate are present (see Figure 1c).

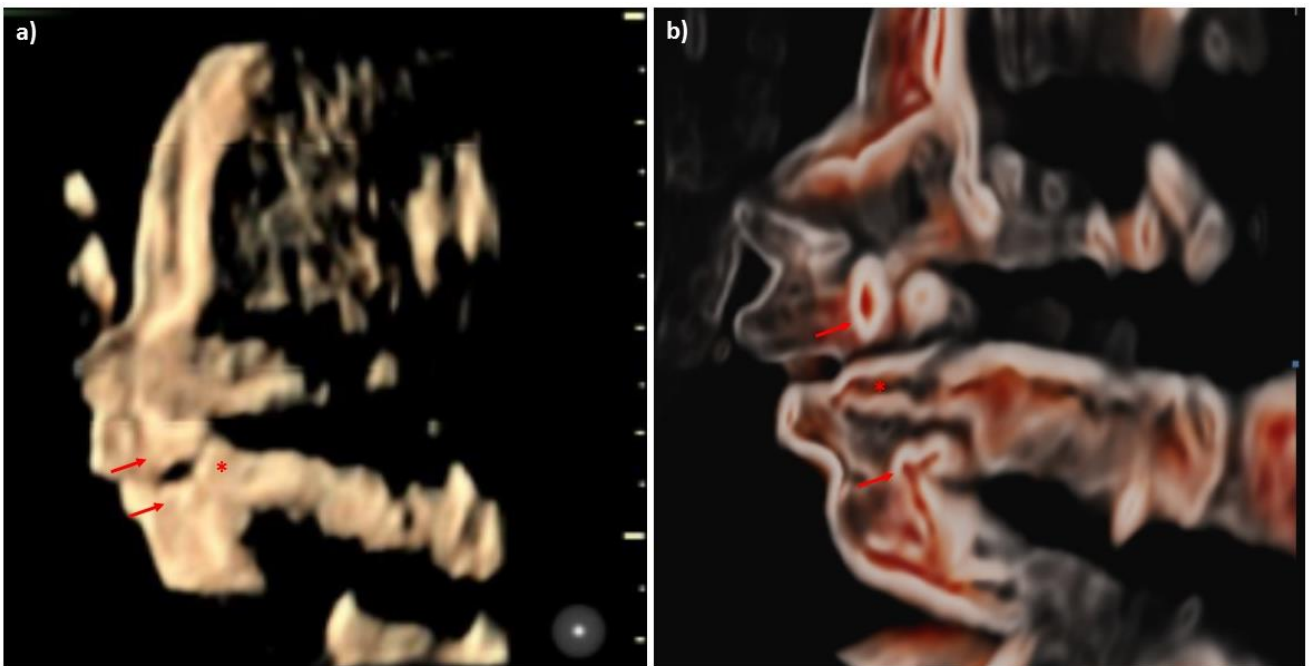


Figure 3 – Multiplanar midsagittal view of the index volume. 1) upper alveolar ridge; 2) lower alveolar ridge; 3) tongue; 4) upper portion of the secondary palate. The dotted lines mark the border of what is inside the fetal mouth, which we interpret as amniotic fluid given the attitude of the fetal mouth. No shadowing can be noted other than in the mid-lower portion of the secondary palate, which is pointed by the arrow.

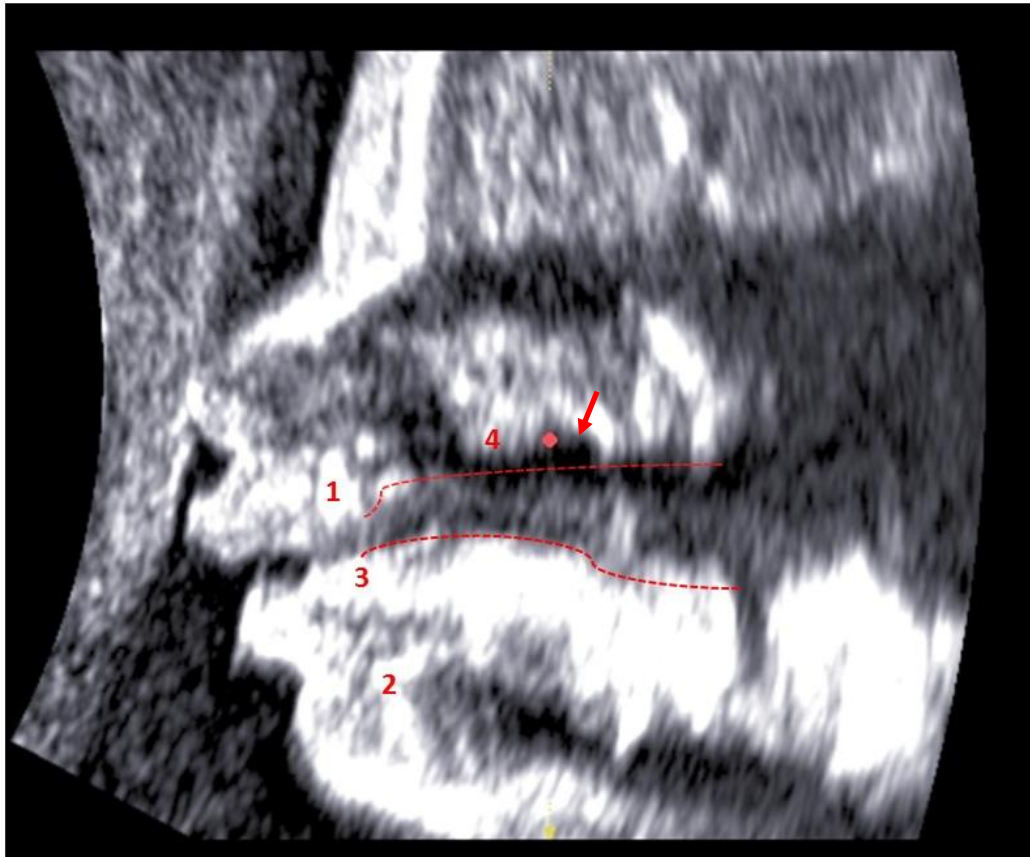


Figure 4 – Two-dimensional (a) and multiplanar and rendered views (c) of the normal fetal palate in the second trimester. In (a) the two-dimensional sagittal view acquired with the ultrasound beam directed cranially shows clearly that the palate is arched and thick and its borders are pointed by the arrows. In (b), multiplanar imaging confirms the anatomical properties of the normal palate, which can be seen in the coronal (upper left), sagittal (upper right, arrows pointing the borders of the palate) and axial (lower left) planes.

