

Pre-operative Tractography of the Facial Nerve in Vestibular Schwannomas: Inter-Observer Agreement with Surgical Findings

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Purpose

Pre-operative diffusion tensor (DT) tractography is currently employed in our Institutions. We use it to predict the course of the facial nerve (FN) in the vicinity of vestibular schwannomas (VS) of the cerebellopontine angle (CPA). In this study we were interested to assess the inter-observer reproducibility of this method. Two Neuroradiologists (PMGP and TT) determined independently the location of the FN by tractography and compared the results with in-vivo findings of microsurgery of VS.

Methods and Materials

14 patients with histologically proven VS were evaluated. DT images (1,5T) and tractography of the FN was performed accordingly to the method of Taoka T. et al^{1,2}. Briefly, DT images were obtained with a single-shot echo-planar sequence (TR 4900 msec, TE 85 msec, b 1000 sec/mm², six-axis encoding, FOV 230 mm, matrix 128 x 128, spacing 3 mm, 4 averages, 35 slices). For each patient, the most convex angle that the FN tract formed between its extremities in the axial plane was calculated as an index of displacement (*Figures 1 and 2*). Data was correlated to the size of the tumors (Koos scale) and Inter-observer agreement was determined (ICC - Intraclass Correlation Coefficient).

Figure 1

Right-CPA grade 4 Vestibular Schwannoma.

(A) Axial T1 pos-Gad.

(B) Facial nerve pre-operative tractography (PMGP), upper-view with orthogonal reference planes.

(C) Axial plane FN tractography (PMGP). The displacement angle is 105°.

(D) Axial plane FN tractography (TT). The displacement angle is 111°.

Figure 2

Corresponding surgical image for the case shown in Fig.1. Pre-operative tractography matched the exact location of the facial nerve.

Images for this section:

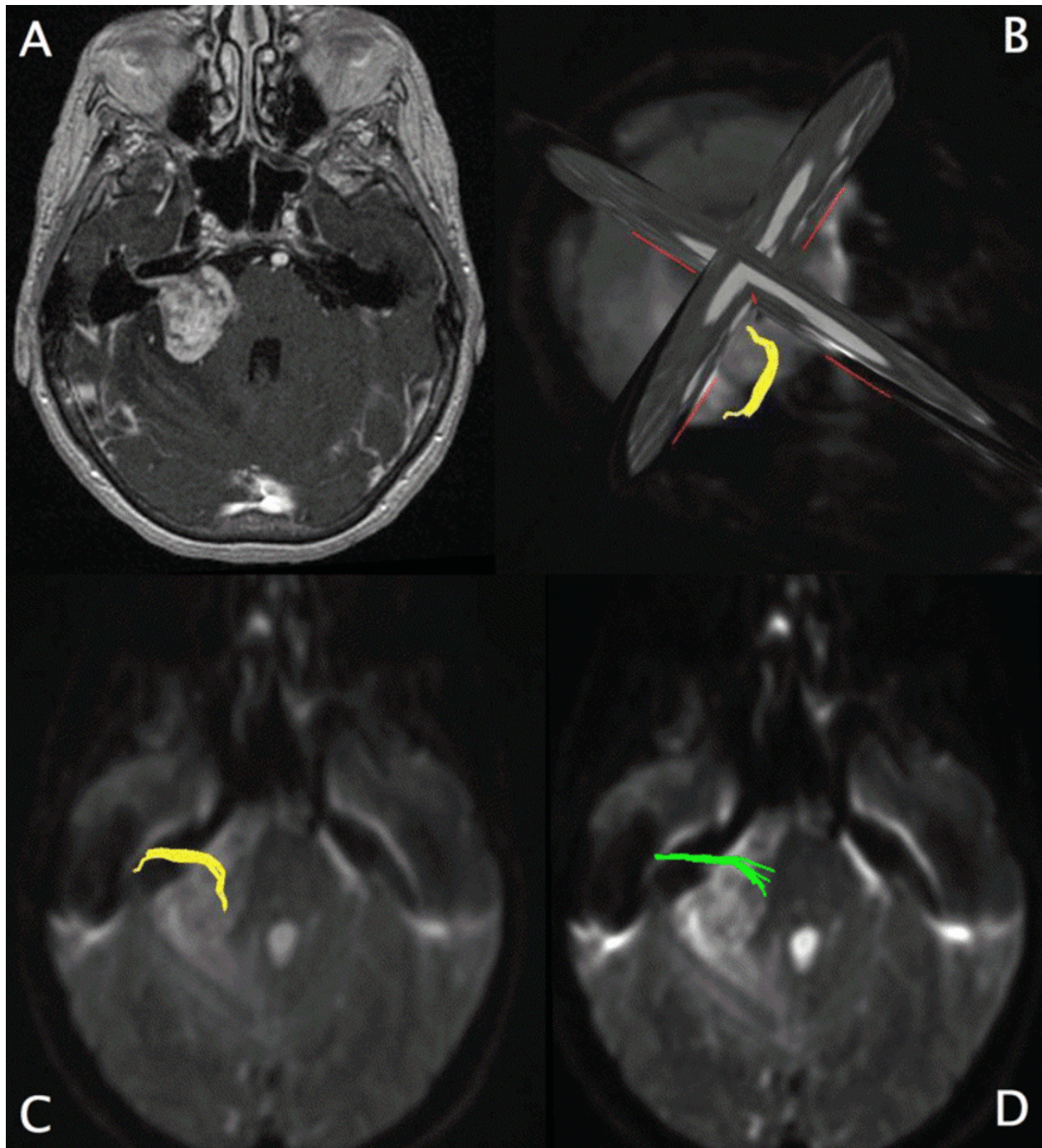


Fig. 1: Right-CPA grade 4 Vestibular Schwannoma. (A) Axial T1 pos-Gad. (B) Facial nerve pre-operative tractography (PMGP), upper-view with orthogonal reference planes. (C) Axial plane FN tractography (PMGP). The displacement angle is 105°. (D) Axial plane FN tractography (TT). The displacement angle is 111°.

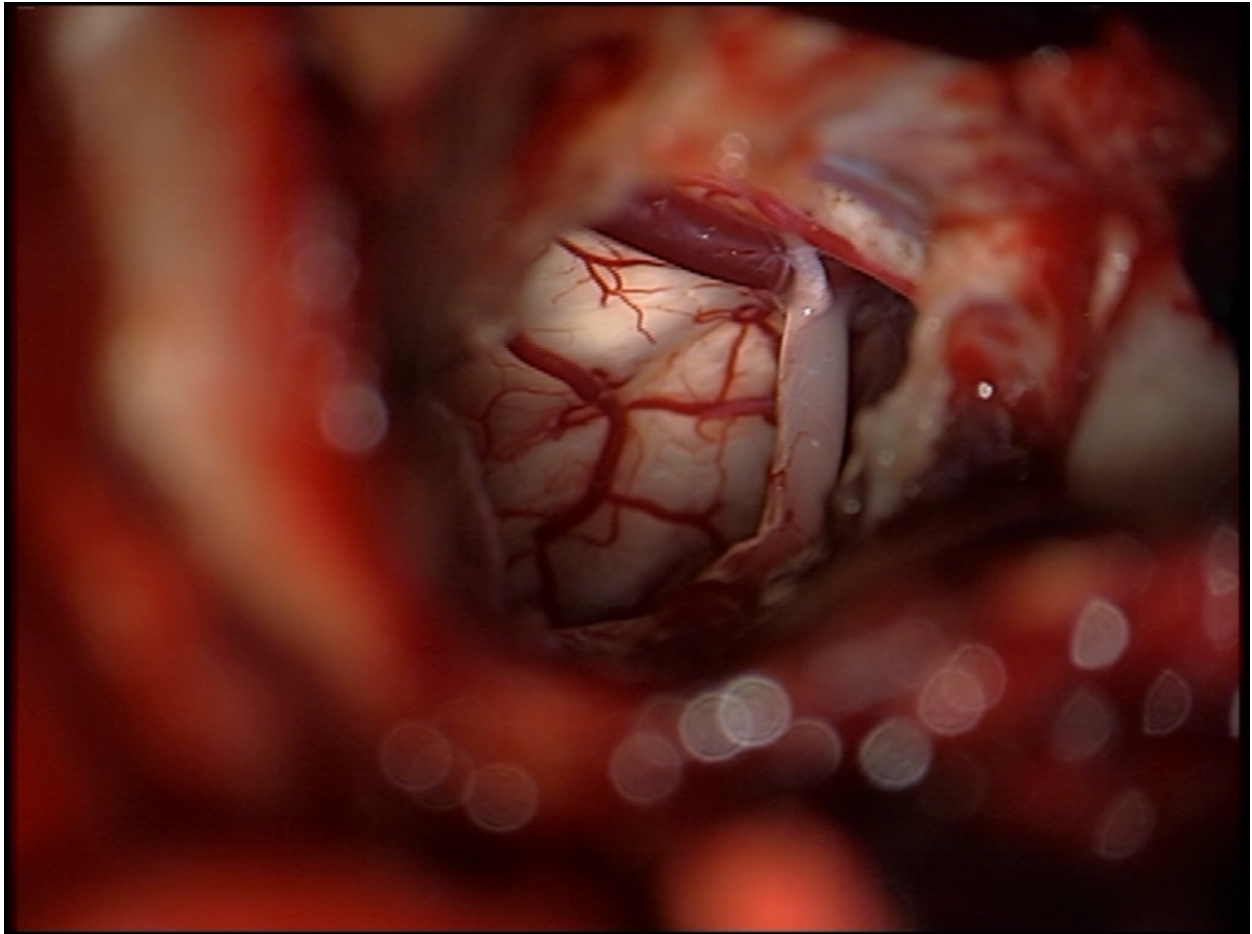


Fig. 2: Corresponding surgical image for the case shown in Fig.1. Pre-operative tractography matched the exact location of the facial nerve.

Results

The FN position was illustrated by DT tractography in all the patients of this series, with a good correspondence between the CPA course of the FN found at surgery and tractography (one grade 4 VS had the FN intra-tumoral). As expected (*Table*), the FN bundles with more acute angles were associated with larger tumors (PMGP: $R^2=0,620$; TT: $R^2=0,684$). Additionally, tracts determined by each observer were highly correlated ($R^2=0,977$; ICC=0,98 $p<0,001$).

Figure 3

(A) Correlation between the displacement angle of FN tracts and Koos Scale for both PMGP ($R^2=0,620$) and TT ($R^2=0,684$) observers.

(B) Association between the displacement angle from both observers ($R^2=0,977$).

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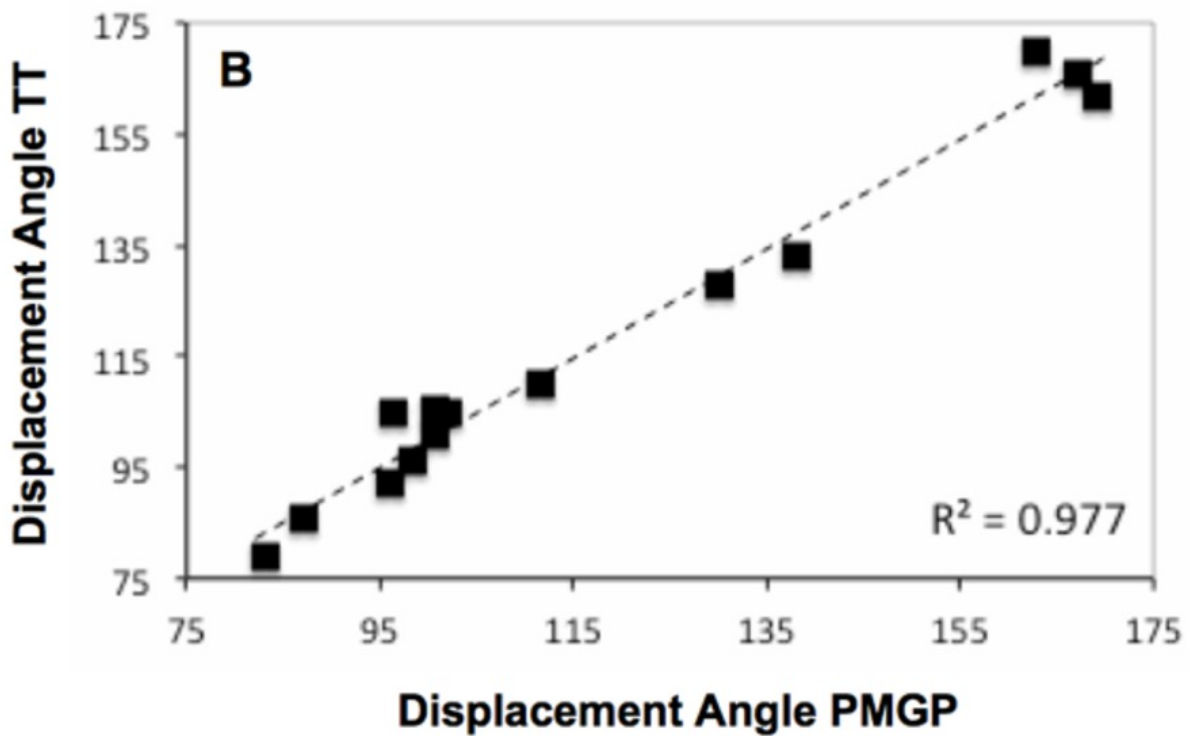
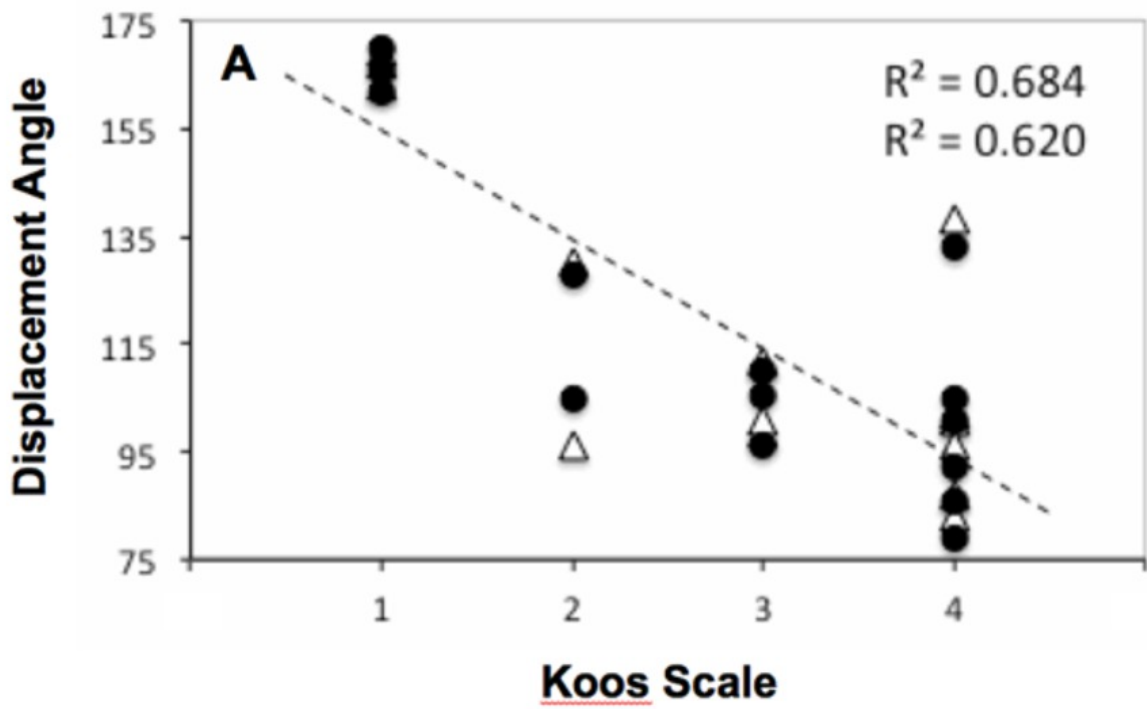


Fig. 3: (A) Correlation between the displacement angle of FN tracts and Koos Scale for both PMGP ($R^2=0,620$) and TT ($R^2=0,684$) observers. (B) Association between the displacement angle from both observers ($R^2=0,977$).

Conclusion

DT tractography of the facial nerves shows a consistent correspondence with the surgical findings and the displacement relates with the space occupying effect of the tumor. Using a strict consensus guideline, independent observers can reach a high level of agreement for the pre-operative position of the FN bundles.

References

Reference

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2 - Gonçalves Pereira PM, Neto D´Almeida G, et al. Surgical proven location of the Facial Nerve in the vicinity of Cerebellopontine Angle Tumours depicted pre-operatively by Tractography. ESMRMB 2012 p.394-395.

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