3D Stereolithographic Modeling of an Inverted Papilloma

This middle-aged woman presented for the first time to ENT clinic with a complaint of nasal stuffiness.

Computed Tomography (CT) of the paranasal sinuses was performed following clinical review that revealed a left intranasal mass.

Due to a radiological suspicion of an inverted papilloma, Magnetic Resonance Imaging (MRI) of the paranasal sinuses was performed.

Figure 1A. Coronal CT Paranasal Sinuses (bone widows) showing complete opacification of the left maxillary sinus and left ethmoidal air cells with widening (*) of the osteomeatal complex. B. Axial CT Paranasal Sinuses (Bone windows) showing opacification of both frontal sinuses with destruction of the posterior wall of the right frontal sinus (arrow).

Figure 2A. Coronal MRI Paranasal sinuses (T2 fat sat) showing mass (P) in the left ethmoid sinus widening the osteomeatal complex with post-obstructive fluid in the maxillary sinus (F). B. Axial MRI Paranasal sinuses (T2 fat sat) showing mass (wide arrow) occupying most of the frontal sinuses with only a slither of sinusoidal fluid (thin arrow).
FROM THE VIEWBOX

This, combined with endoscopic biopsy confirmed an inverted papilloma.

Following referral to oral maxillofacial surgery (OMF), 3D modelling was performed using the original CT data to aid surgical planning.

In this illustrative case a mass occupies the left ethmoidal and frontal sinuses with destruction of the floor of the anterior cranial fossa (Figure 1 A,B) with further delineation on MRI (Figure 2 A,B). This case of an inverted papilloma illustrates the tremendous assistance that 3D modelling offers to the surgeon in examining the anatomical extent of the tumor, visualising their surgical approach and planning the operative procedure. (Figure 3) For example, in this case a combined procedure between the OMF and the neurosurgery departments was undertaken with a bifrontal craniotomy and maxillectomy. Operating times have also been shown to improve following the use of 3D models as preparation prior to surgery is more robust.3

DISCUSSION

Dramatic technological advancements in the fields of medical imaging and computer aided design (CAD) in the past decade have enabled stereolithographic 3D modelling to evolve from a research aspiration to everyday reality.

The widespread availability of high-resolution volumetric data sets, providing isotropic imaging from cross-sectional imaging studies allows for exquisite 3D model production using rapid prototyping techniques.1

Although its domains are ever widening, its use is most established in the fields of oral maxillofacial (OMF) surgery and otolaryngology enabling surgical planning in anatomically complex areas which often require lengthy and complex surgery.2 Similarly, in these fields the 3D modelling assists in prosthesis design and production with additional professional advantages such as teaching aids and aiding patient consent.

REFERENCES