Exploring Clinical Anatomy of Temporal Migraine: New Insights from Zygomaticotemporal Nerve Mapping

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OBJECTIVE

Migraine headache is a widespread neurological disorder, affecting approximately 1 out of 7 people globally (1). In recent years, surgical interventions targeting irritated craniofacial nerves have emerged in the management of pharmaco-refractive migraine headache (2). The temporal trigger site is one of the most common migraine headache sites, involving the entrapment of the zygomaticotemporal nerve (ZTN) (3). Despite high success rates, incomplete depiction of all trigger points is seen as the main cause for surgical failure (4).

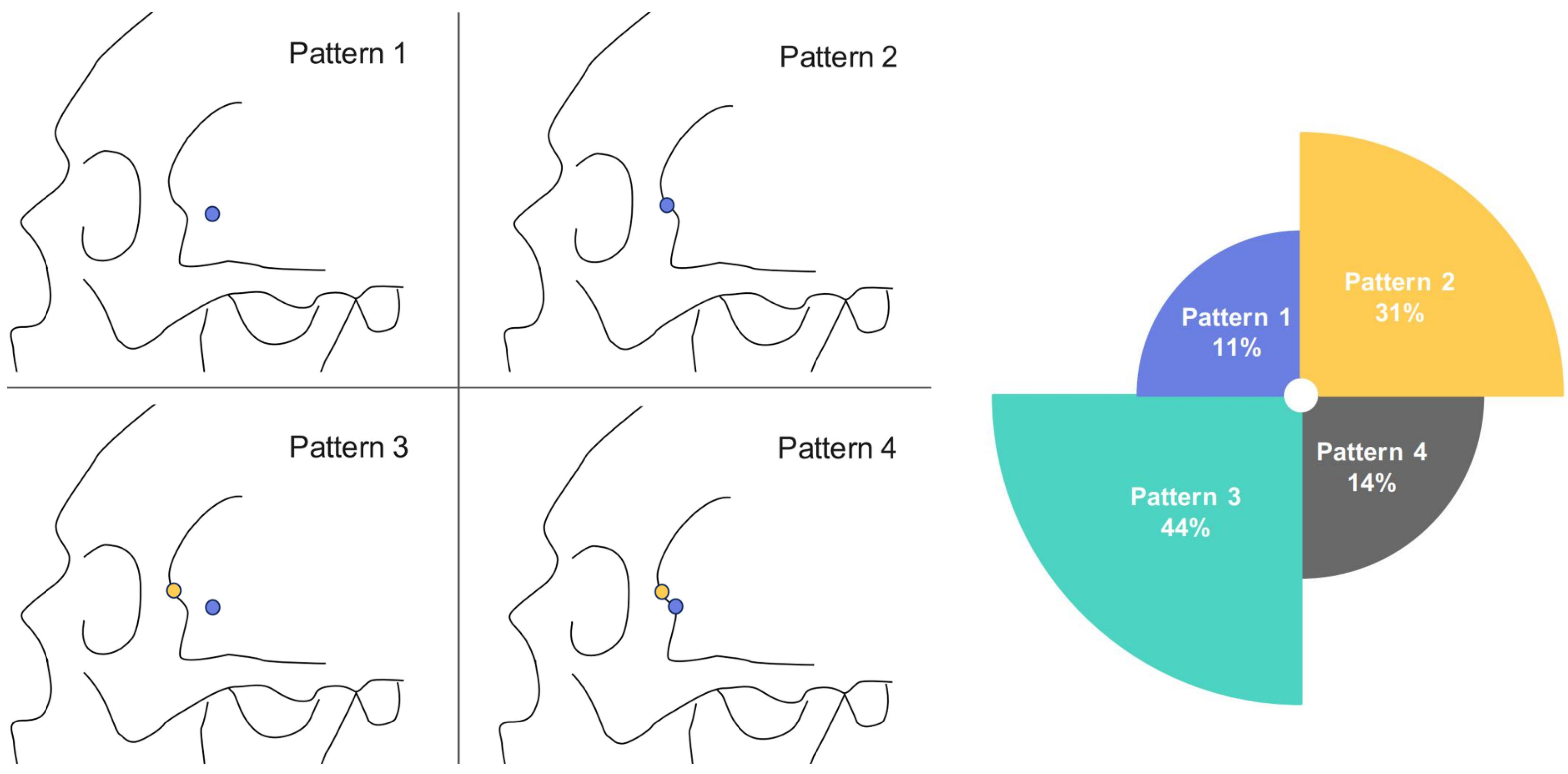
MATERIAL AND METHODS

A total of 34 human body donors underwent bilateral dissection of the temporal region (68 hemifaces). By conducting a macroscopic, stratigraphic layer-by-layer-dissection, potential piercing points of the ZTN within the superficial (SLTF) and deep layer of the temporal fascia (DLTF) were identified. We defined a Cartesian coordinate system with the Frankfurt plane as x-axis and a perpendicular plane through the marginal process of the zygomatic bone (MP) as y-axis. The ZTN's course, exit point (EP) characteristics, and nerve-vessel topography were investigated to develop a clear anatomical mapping of the temporal region.

RESULTS

At the level of the DLTF, we found four different patterns of exit point distribution, depending on their position to the MP, and the presence of an accessory branch.

Figure 1. *Schematic illustration of four different exit point patterns within the DLTF (left), and proportion of each pattern in 64 body donors (right).*



Blue dot, EP of the main branch; yellow dot, EP of the accessory branch

We found the number of main branches exiting the DLTF to be a predicting factor for the presence of an additional EP; therefore, multiple branches within the DLTF were strongly associated with the existence of a separate accessory branch ($p < 0.001$).

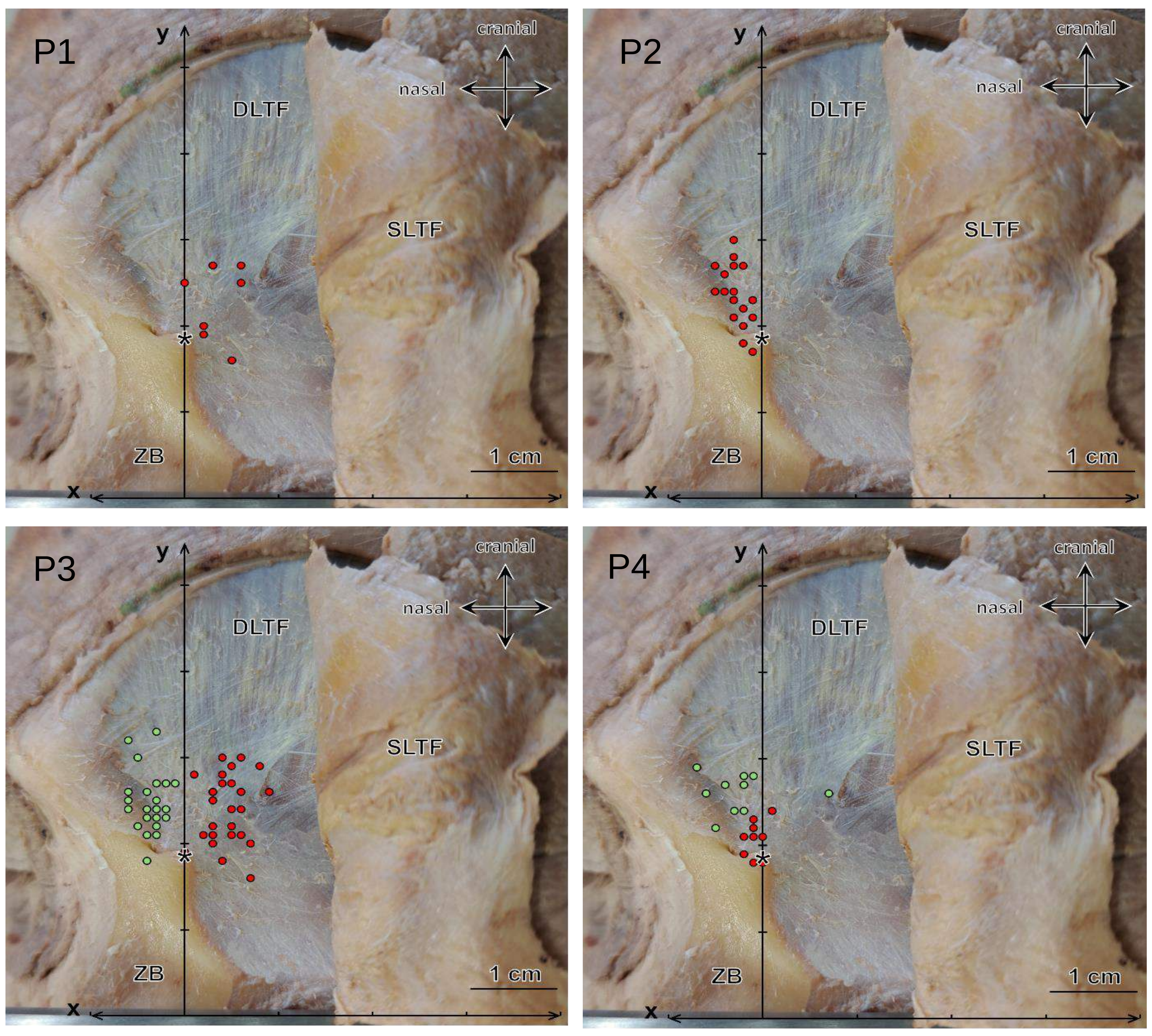


***Figure 2. Four different patterns (P1-P4) of exit point distribution within the DLTF**. The exit points of the main (red) and the accessory branch (green) are illustrated. X-axis, Frankfurt plane, y-axis, MP level, 1-cm scale. DLTF, deep temporal fascia; SLTF, superficial temporal fascia with residuals of the temporal fat pad; ZB, zygomatic bone; *, marginal process of the zygomatic bone.*

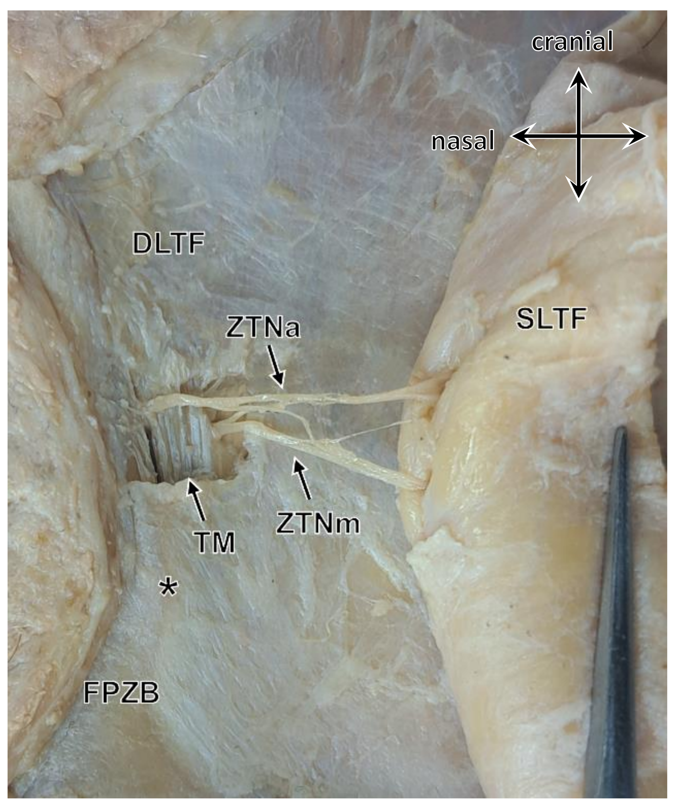


Figure 3. Intramuscular course of the main branch. *DLTF, deep layer of temporal fascia; FPZB, frontal process of the zygomatic bone; ZTNa, accessory branch; ZTNm, main branch; SLTF, superficial layer of the temporal fascia; TM, temporalis muscle; *, marginal process of the zygomatic bone.*

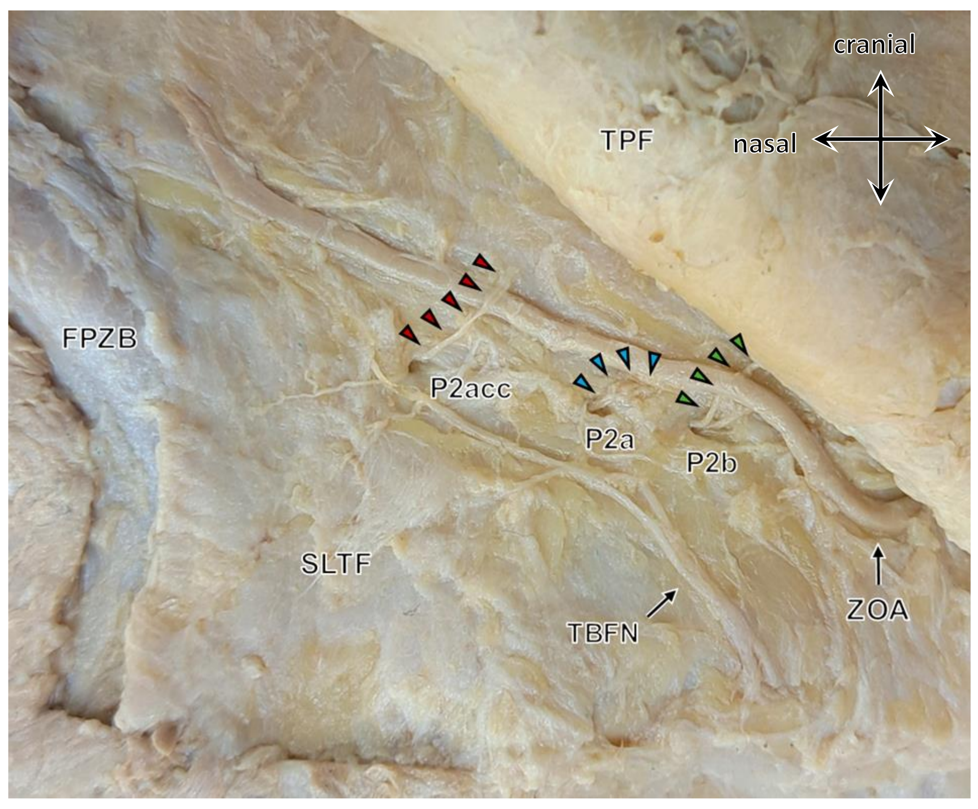


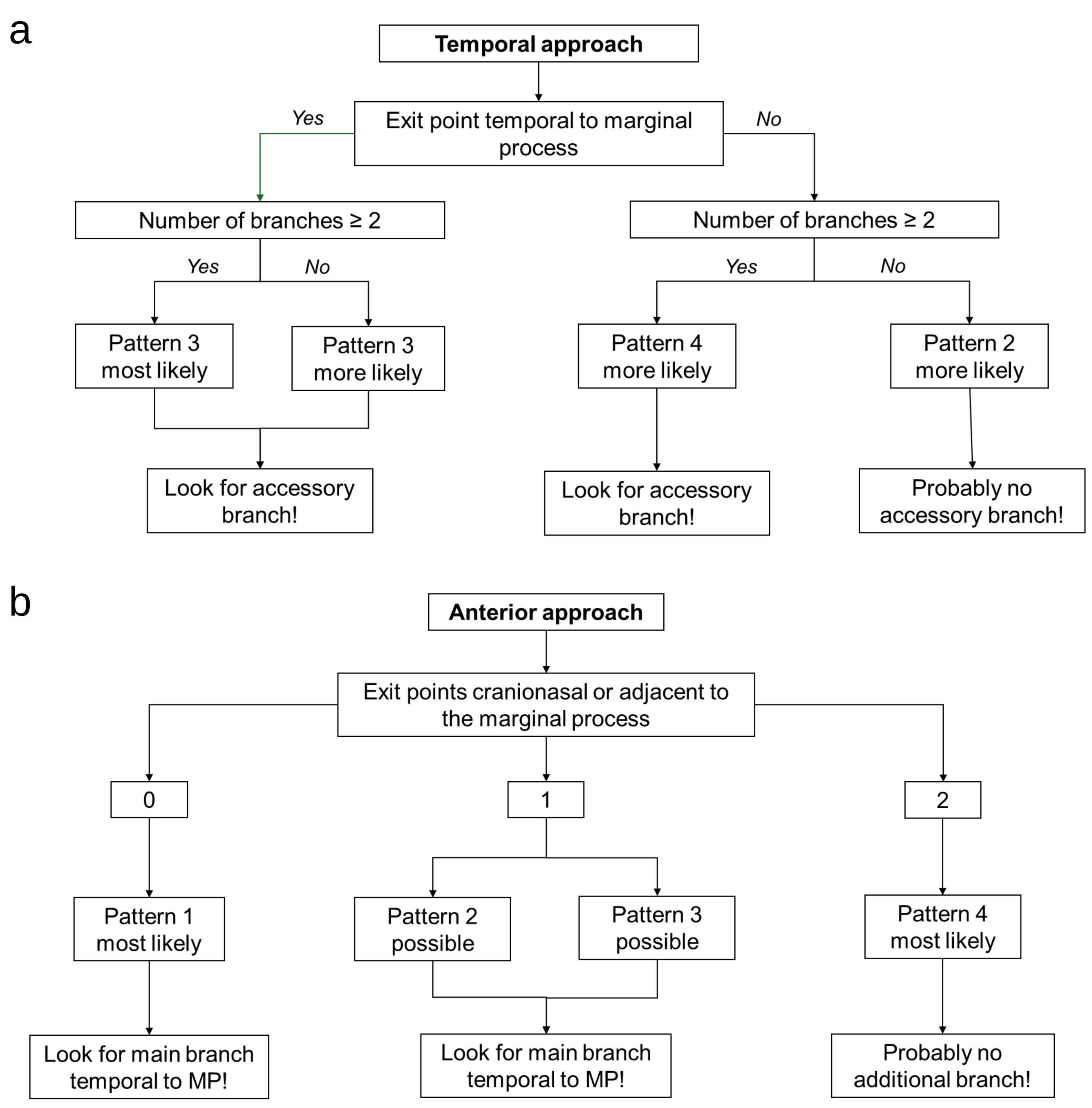
Figure 4. Intersection between the ZTN and ZOA. *FPZB, frontal process of the zygomatic bone; P2acc, exit point of accessory branch within the SLTF; P2a-b, exit points of the main branch within the SLTF; SLTF, superficial layer of the temporal fascia; TBFN, temporal branch of the facial nerve; TPF, temporoparietal fascia; ZOA, zygomatico-orbital artery.*

We detected a potential muscular entrapment in 16 % of hemifaces due to an intramuscular course of the ZTN within the temporalis muscle. Concomitant arteries were found to accompany the ZTN exiting the DLTF in approximately 90 % of cases, as well as in 71-89 % piercing the SLTF. Furthermore, we identified an intersection with the zygomatico-orbital (ZOA) and/or the superficial temporal artery (STA) in 31 %, with the ZTN either crossing over, running under, or travelling parallel to the ZOA. No statistical difference was noted between sexes or sides.

INTRAOPERATIVE NERVE MAPPING

Based on location and/or number of branches, we developed an intraoperative algorithm enabling a quick evaluation of the ZTN's exit points and probability assessment of additional branches.

Figure 5. *Intraoperative algorithm to predict additional branches of the ZTN during migraine surgery with endoscopic or anterior temporal approach (a), and anterior approach (b) (2)*



CONCLUSION

We present a novel classification system of the ZTN's peripheral anatomy and provide an intraoperative algorithm for temporal migraine surgery. Furthermore, we found a novel vascular compression point that may be considered in preoperative diagnostics and surgical procedures.

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