THE USE OF THE ULTRASOUND OSTEOTOME (PIEZOSURGERY) AS AN INNOVATIVE AND SAFE TECHNIQUE TO APPROACH CEREBRAL LESIONS

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Disclosure

All authors do not have any financial or organizational relationships with commercial interests or other entities. All authors hereby certify that to the best of their knowledge, no aspect of their current personal or professional circumstances places them in the position of having a conflict of interest with their duties, responsibilities and exercise of independent judgement.
INTRODUCTION

• The introduction of piezoelectric devices in cranial and spinal neurosurgery is recent
• The declared advantage of such technology relies on its capacity to remove bone without damaging the underlying soft tissues, preciseness of bone cutting and faster bone healing and potentially preservation of cranial nerves and vascular structures
• Starting from this concept, we evaluated the use of piezoelectric drill in a series of patients operated for intracranial lesions
METHODS

Our series: 92 patients (January 2009-January 2019)

- 16 underwent a median parasagittal approach;
- 7 underwent with supraorbital approach;
- 28 were subjected to retrosigmoid approach;
- 5 underwent with transpetrosal approach;
- 16 underwent with pterional approach with clinoidectomy;
- 20 were subjected to presigmoid transetrolabirhythine approach.

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Number of cases</th>
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<tbody>
<tr>
<td>Meningiomas</td>
<td>52</td>
</tr>
<tr>
<td>Schwannomas</td>
<td>24</td>
</tr>
<tr>
<td>Craniopharyngioma</td>
<td>8</td>
</tr>
<tr>
<td>Epidermoid cyst</td>
<td>4</td>
</tr>
<tr>
<td>Low grade gliomas</td>
<td>4</td>
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</tbody>
</table>

The drill hole was performed only in 12 patients, while in the remaining patients it was not necessary.

Pre-operative and 6-month 3D-bone reconstruction CT scans were evaluated to verify the ossification of the craniotomic edges and possible complications. The minimum follow-up was 6 months.
RESULTS

- **Venous sinus rupture** occurred in none of the patients undergoing craniotomy with the piezo-osteotome.
- Only in one case a thrombosis occurred in the confluence between the sigmoid and transverse sinuses, not necessarily related to the craniotomy step.
- **No post-operative CSF fistula** occurred.
- The **ossification rate** of the craniotomic borders was **70% at three months** and over **90% at nine months**. In no case bone resorption or mobilization has been documented.
- The use of piezosurgery to perform clinoidectomy, petrosectomy and to drill the orbit’s roof and the posterior wall of the acoustic internal meatus didn’t cause any damage to the surrounding neuro-vascular structure. No disadvantage due to microvibrations was noticed.
ILLUSTRATIVE CASE 1

A 45 y.o. woman, came to our attention for occasional right trigeminal neuralgia and ataxia. A brain MRI without and with contrast agent showed a right ponto-cerebellar lesion.

Patient underwent surgery to remove the lesion using a retrosigmoid approach (Hysto: Cholesteatoma).
ILLUSTRATIVE CASE 2

A 52 y.o. woman, came to our attention for anosmia and frontal lobe syndrome. A brain MRI without and with contrast agent showed a olfactory groove meningioma.

Fig. 1: Pre-operative MRI.

Fig. 2: Post-operative CT SCAN and MRI with evidence of craniotomy results.
DISCUSSION

 ✓ The **Piezosurgery** is a new promising technique for **selective bone cutting** with soft tissue preservation.

 ✓ This instrument is particularly suitable for **skull base surgery** because it allows to perform osteotomies also near neurovascular structures and eloquent areas, without damaging them.

 ✓ Furthermore, in our experience, this tool allows to reach a **better and faster ossification of the craniotomy borders**, verified during the follow-up, with significantly superior **aesthetic results** compared to traditional craniotomies by mechanical instruments.
SUMMARY POINTS

• Piezosurgery provides **safety, preciseness of bone** cutting with faster bone healing.

• We treated 92 patients between January 2009 and January 2019 for cranial surgery.

• The **ossification rate** of the craniotomic borders was 70% at three months and over 90% at nine months. In no case bone resorption or mobilization has been documented.

• The use of piezosurgery to perform **clinoidectomy, petrosectomy** and to drill the orbit’s roof and the posterior wall of the acoustic internal meatus didn’t cause any damage to the surrounding neuro-vascular structure.

• **No post-operative CSF** leakage occurred.