CASE REPORT for medical professionals

USEFULNESS OF ULTRASONIC SURGICAL DEVICE ZAOSONiC IN OTOLARYNGOLOGY SURGERY

- PRACTICAL APPLICATION IN SHORT STAY SURGICAL FACILITIES -

By
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Biography

1997: Medical degree from Kurume University School of Medicine
1997: Post-graduate study, Kurume University School of Medicine, Department of Otorhinolaryngology and Head and Neck Surgery
2000: Assistant at the Department of Otorhinolaryngology, Kurume University School of Medicine
2006: Medical Science doctorate
2008-2014: Lecturer, Department of Otorhinolaryngology, Kurume University Hospital
2009: Research Fellow at Kresge Hearing Research Institute, University of Michigan, USA
2011: Medical Fellow at Gruppo Otologico, Italy
2014: Opened Ueda Clinic, Otorhinolaryngology and Dermatology Department

SURGICAL PROCEDURES AT OUR CLINIC

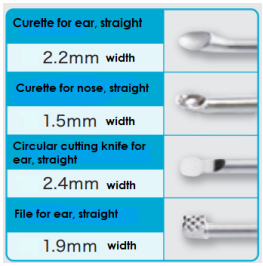
Our clinic operates as a short-stay surgical facility, focusing on outpatient surgery. In the field of otolaryngology, we perform microscopic and endoscopic ear surgeries for chronic otitis media and cholesteatoma-related otitis media (excluding cases with expected progression to the dura or semicircular canals). For rhinology, we perform endoscopic nasal and sinus surgeries for allergic rhinitis, deviated nasal septum, and chronic sinusitis.

BACKGROUD OF ADOPTION OF THE ZAOSONiC

In ear and nasal surgery, bone osteotomy is often performed after creating a skin or mucosal flap and exposing the bone. When performing bone osteotomy near the skin or mucosal flap or sensitive soft tissues such as the dura, blood vessels, and nerves, it is essential to have a power device to perform bone osteotomy firmly without causing bleeding or entangling the surrounding soft tissues.
Traditional instruments like chisels, gouges and drills, as well as ultrasonic surgical devices, have been used for bone osteotomy, but sharp devices like chisels, gouges and drill burrs can lead to significant bleeding from the bone edges even when there is a large amount of bone removal.
In that case, hemostasis by wax or coagulator is required. For adequate management of postoperative bleeding in short-stay surgeries, it is crucial to minimize bleeding rather than perform hemostasis.
Drill-based devices for rotational bone osteotomy can entangle the surrounding soft tissues, so careful drill operation is needed after sufficient flap peeling.
The Ultrasonic Surgical Device ZAOSONiC was developed to address these challenges.
It is made in Japan and developed by DAIICHI MEDICAL CO., LTD., MICRON MACHINERY CO., LTD., and Yamagata University. This device can break high-hardness bone by compressive vibration while avoiding damage to low-hardness soft tissues.
Ear, nose, and throat (ENT) specialists helped develop the ZAOSONiC so it includes the chisel-shaped tips that we are familiar with. Compared to other ultrasonic surgical devices, the ZAOSONiC's chisel-shaped tips facilitate easy bone removal and have high osteotomy capability.
The ZAOSONiC also has bone fragmentation, cleaning, and suction functions which allow effective cleaning of osteotomized bone fragments by irrigation. This provides excellent visualization and is beneficial for endoscopic nasal and sinus surgeries and transcanal endoscopic ear surgery (TEES).
In this report, I will introduce the characteristics of the ZAOSONiC and provide examples of surgeries performed using the ZAOSONiC.

ZAOSONiC CHARACTERISTICS AND INTRODUCTION OF TIPS

The ZAOSONiC generates the power for bone osteotomy by applying ultrasonic vibrations to the tip. Unlike drills which cut when pressed against the bone, the ZAOSONiC has a curette-shaped tip which requires scraping and scooping motions, similar to using a bone curette. These motions are assisted by ultrasonic vibration, making it a bone osteotomy device.
The stroke of the tip's vibration is around 80 μm which is very fine. This ensures minimal risk of entangling soft tissues and reduces the risk of damaging soft tissue.
However, the vibration generates heat, so cooling through irrigation is necessary. To reduce splatter of irrigation and blood, the device produces suction between the tip and the tip guard.
The tip and tip cover components can be cleaned and sterilized, making them reusable, which is more cost effective than disposable products.
The tip originally came in three shapes, curette, circular cutting knife, and file, but to improve usability in TEES, a small 1.5 mm width curette was also added.



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Key Points of Surgery Using ZAOSONiC (Practical Application)

Usage Points

The ZAOSONiC is particularly useful in areas where soft tissues in close proximity to the bone removal site, such as skin flaps or nerve tissues, need to be preserved.
Several tip types are available, but I prefer the curette-type. Since the tip is curette-shaped, it is used in the same manner as a regular curette. The tip is placed on the bone surface, and bone removal is performed by either pulling it towards the operator or rotating the curette axis against the bone.
The key point is to remove the bone without applying excessive force.
The device provides sufficient power for bone removal, similar to peeling off a thin skin.

Ear Surgery

Bone Removal in the Deep External Auditory Canal

In tympanoplasty, bone processing in the deep external auditory canal is a frequently used technique. When confirming the I-S (incudostapedial) joint (Photos 1 and 2), bone removal is necessary while preserving the tympanomeatal flap and chorda tympani nerve. When using a drill, there is a risk of soft tissue entanglement. So, the use of sponge material or similar covering is needed to protect the soft tissues. With the ZAOSONiC, there is no risk of entanglement, and the risk of soft tissue damage is significantly reduced. To prevent temperature elevation in the removal area, it is important to perform irrigation while removing the bone.

Prospects in Otolaryngology

Since there is no water current or bubbles associated with drill rotation, the ZAOSONiC is considered useful in water-based endoscopic ear surgeries. It is also deemed useful in mastoidectomy procedures, where cholesteatoma membranes or dura need to be preserved while removing bone within the middle cranial fossa.

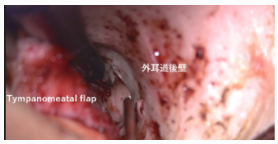

Photo 1: Bone osteotomy in the deep external ear canal to confirm mobility of the ossicular chain (left side).

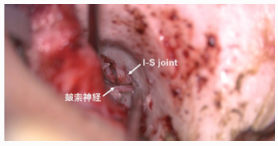

Photo 2: Preserving the chorda tympani nerve and confirming the incudostapedial (I-S) joint (left side).

Nasal Surgery

Treatment of Bone Spurs in Nasal Septoplasty

Bone spur treatment is often necessary to improve nasal morphology (Photo 3). While a chisel or gouge is commonly used, these have risks of removing the turbinate bone with potential damage to the greater palatine artery branch. Use of a diamond burr drill is also considered, but this may involve the nasal septal mucosa and cause flap damage. Therefore, sufficient peeling is needed. With the ZAOSONiC, there is no risk of entangling soft tissues, allowing for minimal dissection (Photo 4). The curette-shaped tip allows additional dissection if needed, similar to using a regular curette.
When the ZAOSONiC is used, there is minimal bleeding, making it easier to shape the nasal septum morphology (Photo 5).

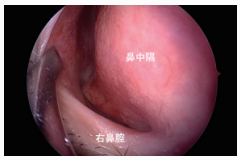

Photo 3: Pre-operative view of nasal septum surgery shows severe deformity of the vomer and bony ridge, leading to the formation of bone spurs (right side)

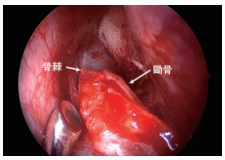

Photo 4: Bone removal at the site of vomer deformity (right side)

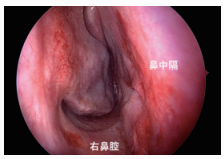

Photo 5: Post-operative view of nasal septum surgery with Improvement in nasal septum curvature and nasal cavity morphology (right side)

Treatment of the Base of Inferior Turbinates Bone in Submucosal Inferior Turbinoplasty

The bone tissue at the base of the inferior turbinate is often thick in the posterior region, and inadequate removal could result in insufficient improvement of nasal airflow. When dealing with the posterior nasal nerve branches within the inferior turbinate, it is essential to expose the nerve as far as possible towards the posterior end of the turbinate (Photo 6). There is also a risk of damaging blood vessels that run alongside the nerve. This needs careful attention.
The ZAOSONiC can minimize damage to the mucosal flap and reduce bleeding, which allows effective removal of the inferior turbinate bone (Photo 7).

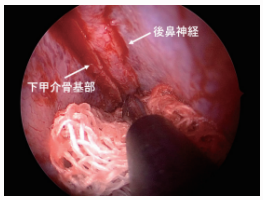

Photo 6: Protrusion of the basal part of the inferior turbinate bone, with bone removal of the basal part of the inferior turbinate bone to visualize the course of the posterior nasal nerve (right side)

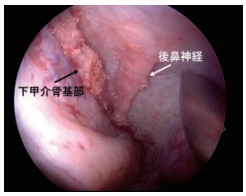

Photo 7: Sufficient removal of the basal part of the inferior turbinate bone to expose the posterior nasal nerve (right side)

Developments in Nasal Surgery

For procedures like dacryocystorhinostomy (DCR) and endoscopic frontal sinus surgery where mucosal flaps are located nearby, the ZAOSONiC has advantages over drill-based devices which use rotational bone removal.

FUTURE PROSPECTS

Needless to say, the ZAOSONiC is useful in transcanal endoscopic ear surgery (TEES).
I also use the ZAOSONiC in microscopic ear surgery (MES). Further miniaturization of microscope tube is expected to prevent potential interference with the microscope tube.
Currently, curette-shaped tips are only available in straight form, and the development of gently curved tips is anticipated.
Since the ZAOSONiC is domestically manufactured in Japan, speedy improvement is expected.
New advanced tips and gently curved options are already under development (Photo 8).

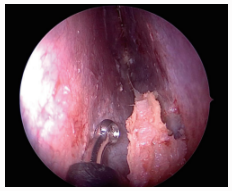

Photo 8: New prototype tip (experimental version)

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