



Technology Eases Pain

A 3D Printed Guide Plate
Simplifies Trigeminal
Neuralgia Surgery

A Pain that Searns

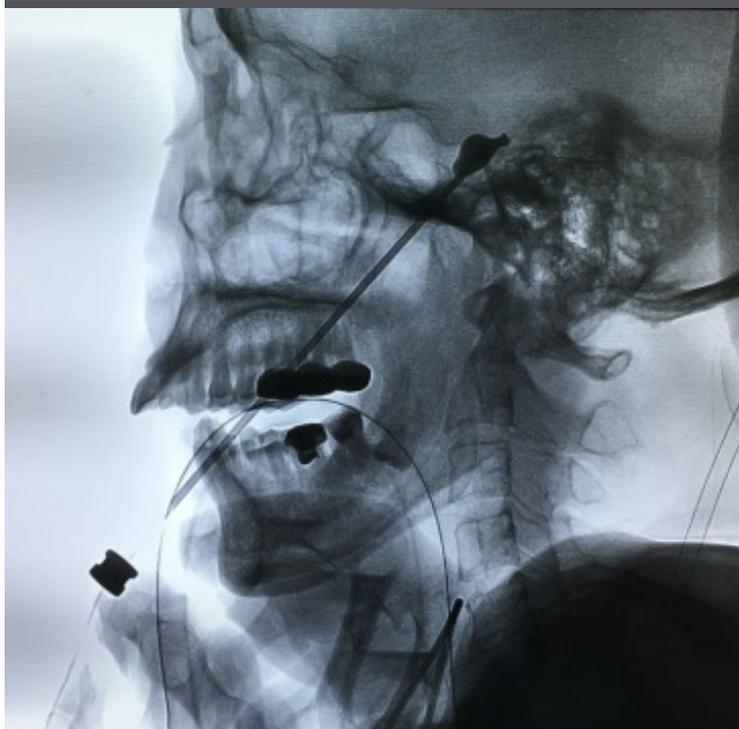
Trigeminal neuralgia is a chronic pain condition that affects the trigeminal nerve, one of the most widely distributed nerves in the head that carries sensation from the face to the brain. For patients with this disorder, even mild face stimulation, such as brushing teeth, shaving, or applying makeup, can trigger a jolt of excruciating pain. Initially, symptoms that mainly occur in the throat, jaw, tooth and lip, last only a few seconds and consist of intense, stabbing pain. But over time, they can progress and lead to longer, more frequent bouts of searing pain.



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It is simply amazing how this new technology is helping with medical solutions.”

Dr. Gong
Third Affiliated Hospital
Sun Yat-Sen University



Dr. Gong, at the Third Affiliated Hospital, Sun Yat-Sen University, is an expert in the treatment of trigeminal neuralgia. He typically performs percutaneous micro balloon compression, a procedure in which nerve fibers are damaged to block the pain. Despite the minimally invasive nature of this operation, it is very challenging to accomplish.

“Because everyone’s skull is unique, the location of puncture target varies from person to person,” Dr. Gong explained. “The bones have different shapes, and the soft tissue in the face is also mobile.” To ensure that the needle is inserted at the precise spot and passed through the right path, X-rays are constantly needed. Normally, the patient is subjected to at least five or six X-rays. This not only lengthens the operation, but also exposes both the patient and the doctor to significant radiation. The radiation also increases the damage to the tissues around the oval foramen. To alleviate these problems, Dr. Gong sought out a more efficient way to perform the micro balloon compression.

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The 3D printed facial guide plate made using ULTEM™ 1010 resin

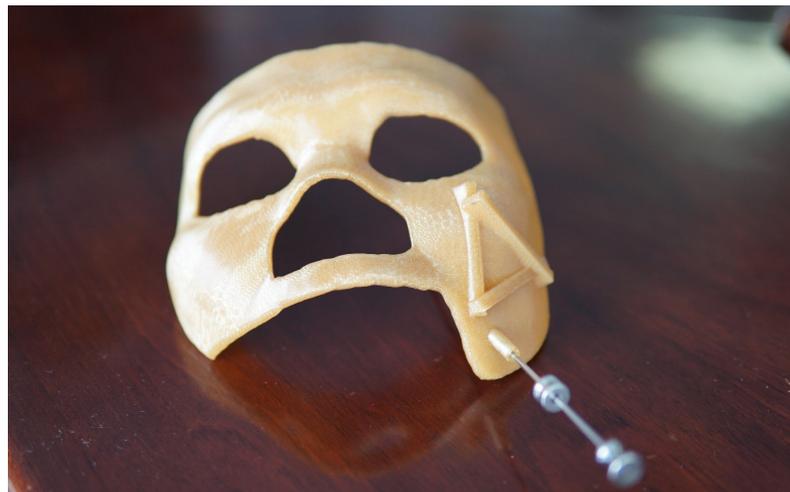


New Hope Lies in Technology

Inspired by other 3D printing surgical applications, Dr. Gong set out to develop patient-specific guide plates to navigate the route to the oval foramen. To assist him, Dr. Gong consulted Klein Wang, application engineer at Stratasys who specializes in medical solutions. Because the guide plate required a high degree of accuracy and strength, Klein decided to print it with the Fortus 450mc™, an FDM® system that can quickly print complex and high-requirement parts with a large variety of material options. With a 406 x 355 x 406 mm (16 x 14 x 16 inch) build size, the Fortus 450mc can print large parts like the guide plate while maintaining a layer thickness as thin as 0.127 mm (0.005 inch). The system is also known for its precision; parts are produced within an accuracy of $\pm .127$ mm (± 0.005 in.) or ± 0.0015 mm/mm (± 0.0015 in./in.). This level of precision is required to ensure that the guide plate fits the patient's face perfectly.

The material Klein selected was ULTEM™ 1010 resin, a high-performance FDM thermoplastic that offers excellent strength, thermal stability and the ability to be sterilized with steam autoclaving. The certified grade is also biocompatible and can be used for custom medical applications. It possesses ideal thermal and mechanical properties and can withstand the high sterilization temperature and pressure without changing shape, allowing the guide to fit precisely on the patient's face during surgery.

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Surgeons discuss the procedure using the 3D printed guide plate before the operation.

Simplifying the Operation

Within two days, Klein shipped the printed guide plate to the Third Affiliated Hospital, Sun Yat-Sen University, where Dr. Gong's patient, an elderly man in his seventies, was waiting for his operation. The patient had been suffering from severe pain in his right cheek for over five years and eating became unbearable for him.

During the operation, everything went as planned. Because the guide plate helped him identify the exact spot for entry on the patient's face, Dr. Gong only used X-ray checks twice, instead of multiple times that are typical. The guide plate also had the right texture; not too hard, so that the needle would not go through, but also, not so thin that the needle would wobble inside the patient's face. There were no unexpected events during the operation, and Dr. Gong completed the procedure within three minutes, instead of 30 minutes. This was a huge relief for the patient, given his

advanced age. In addition, because the procedure was done in a more effective manner and no important structures near the oval foramen were damaged, Dr. Gong believed that the likelihood of complications would be significantly lowered.

Aside from the benefits to the patients, the guide plate also has important educational value. For young doctors who do not have sufficient experience with the procedure, a 3D printed guide plate will help them reach the trigeminal nerve center, shortening their learning curve. The integration between medicine and engineering is a key focus in his hospital's future development, and 3D printing has joined robotics, big data, and AI in helping patients recover. "It is simply amazing how this new technology is helping with medical solutions," commented Dr. Gong. "I hope Stratasys can develop more biocompatible materials for my future research on surgical planning models."

Stratasys Headquarters

7665 Commerce Way,
Eden Prairie, MN 55344
+1 952 937-3000 (Intl)
+1 952 937-0070 (Fax)

stratasys.com

ISO 9001:2015 Certified

1 Holtzman St., Science Park,
PO Box 2496
Rehovot 76124, Israel
+972 74 745 4000
+972 74 745 5000 (Fax)

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