A microstimulator for certain headache types

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Cluster headache is a headache disorder characterized very intense pain attacks centred on one eye and accompanied by ipsilateral autonomic signs. Among affected subjects, primarily men, 10% have the chronic form of the disease which has a relentless course with daily. The majority of chronic cluster headache sufferers become resistant to available drug treatments. There may some good news for them, however; researchers have succeeded in reducing the burden of the disease thanks to an implantable microstimulator of the sphenopalatine ganglion.

Most headache disorders reduce quality of life, but none of them is nearly as painful as cluster headache. It is associated with recurring unilateral facial and head pain that is usually unbearable. The attacks may occur several times per day; they are often nocturnal and last between 30 minutes and three hours. In addition to the pain, they are accompanied by ipsilateral redness of the eye, lacrimation, swelling of the eyelids and nasal congestion/running nose. « Cluster headache affects one person in every thousand, a prevalence comparable to that of multiple sclerosis. In the vast majority of subjects, the most efficient treatment to abort the attack is sub-cutaneous injection of sumatriptan with an auto-injector and/or inhalation of 100% oxygen by mask. However some patients cannot receive sumatriptan
because of cardio-vascular risk factors and, in addition, 10% of patients develop the chronic form of the
disease and become resistant to drugs. These patients have their lives destroyed by the illness and many
become suicidal. » explains Jean Schoenen, director of the Headache Research Unit at the University of Liège
(University Department of Neurology - Citadelle Hospital and GIGA-Neurosciences - University Hospital Sart
Tilman). It is clear that the development of novel effective therapies where available treatments have failed
is an urgent priority!

A micro-stimulator that you can activate yourself

The precise cause of cluster headache is not completely understood, but for several years researchers have
suspected that the sphenopalatine ganglion plays an important role in the onset and continuation of attacks.
This autonomic ganglion which is located in the pterygopalatine fossa behind the upper jaw and innervates
the glands and mucosae of one side of the face, is connected with the trigeminal nerve which conducts
the pain. "The attacks are associated with activation of the sphenopalatine ganglion which explains the
lacrimation, redness of the eye, swelling of the eyelids and nasal congestion. Greenfield Sluder, an American
ENT specialist, was the first to point out the role of the sphenopalatine ganglion in 1903. Since then, we
know that we can interrupt an attack by touching the upper inside of the nostril with a cotton ball soaked in
Bonain's solution, which paralyses the nearby ganglion. Based on this information, Dr Jean-Claude Devoghel
of the University of Liège developed in the nineteen eighties a treatment based on the injection of alcohol
into the sphenopalatine ganglion via the temple", explains Jean Schoenen. As this technique yielded good but
transitory results, researchers tried to find a more lasting way to change the functioning of the ganglion.

In 2010, Ansirinia and his colleagues in Las Vegas proved the concept by stimulating the ganglion with
a temporarily implanted electrode in some hospitalized patients: a high-frequency electrical stimulation
of the sphenopalatine ganglion interrupted 78% of the attacks. "Based on these results, a Californian
company, Autonomic Technologies Incorporated, decided to develop a microstimulator to implant near the
sphenopalatine ganglion via the gum of the upper jaw." It has the form of a small polymer implant without
a battery, wearing several electrode contacts, and adaptable to the anatomy of the pterygopalatine fossa in
each subject. The patient activates the micro-electrode on demand by placing a small electromagnetic field
generator on the cheek.
The implantation method was developed in Liège and it has been steadily improved by doctors Alain Wilmont and Sandrine Machiels, of the Maxillo-facial Surgery and ENT departments of the Citadelle Hospital. The first implants were performed on corpses by implanters coming from several European countries thanks to the facilities supplied by the new dissection and practical workshop rooms of the Anatomy Department at the Sart Tilman University Hospital. "It involves placing the implant in the pterygopalatine fossa through the gums of the upper jaw at a precise point near the ganglion, without touching the second division of the trigeminal nerve, the maxillary nerve and its branches." Once it is in place and the wound has healed, the implanted microstimulator is activated manually by the patients: "When an attack begins, the patient places a little remote controller on the cheek which generates an electro-magnetic field. This field activates the microstimulator which in turn produces a high-frequency electrical stimulation of the sphenopalatine ganglion for 15 minutes. The stimulation blocks the nerve traffic through the ganglion." This novel technique is being studied simultaneously in Germany, Italy, Spain, France, Denmark and Belgium in a multicentre study coordinated by the University of Liège, which includes a double blind phase where certain stimulations are not real (« placebo » stimulations). It has already produced some very encouraging preliminary results!
Less frequent attacks

Up to now, 22 patients have been implanted and the investigators have been able to analyse the preliminary results obtained from 7 of these patients; the others have not yet been enrolled in the study for a sufficient length of time. Jean Schoenen explains, « We have noticed that 70% of the attacks were stopped in the first 15 minutes after starting the microstimulator. This is very encouraging but it is not the only result! We have also noticed in many patients that the more they stimulate their sphenopalatine ganglion the less frequent the attacks become. » Thus, for 6 patients that were tested, frequency of attacks dropped by 80% and the attacks that persisted were less intense. If you add to this the fact that the implant is only accompanied by light transient side effects due to the implantation, you can understand the enthusiasm of investigators and patients! « There is no serious side effect with this technique. For the moment we have only observed a swelling of the cheek in the days following the implant and some transitory pain in the jaw. When the electrode is not properly placed, it can cause facial pain due to the stimulation of the second division of the trigeminal nerve (the maxillary nerve). However, the more the study advances, the more accurate the implantation technique becomes and the risk of a bad positioning of the stimulation electrode decreases. »

The study is only in its initial phase and the recruitment of patients finishes in Autumn 2011. The second set of results should be known in February 2012. In addition, as the sphenopalatine ganglion could also play a role in migraines, the investigators have designed a study protocol in migraine that affects one in five women and can also become resistant to drugs. « The
results in the cluster headache have to be confirmed on the long-term, but they are sufficiently encouraging to test the sphenopalatine ganglion microstimulation in severe migraine, the more so that 1 out of 3 migraineurs also has a red and watering eye, or a stuffed or running nose on the side of an attack. It is again a multicentre European study which we hope will begin in November of this year. », concludes professor Schoenen.