

# Continuous Stimulation Monitoring of the Facial Nerve\*

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## Fasial Sinirin Sürekli Uyarımlı Monitörizasyonu

Kulak ve parotis cerrahisi sırasında fasial sinirin hasar görmesi hem cerrah hem de hasta açısından hoş olmayan bir durumdur. Bu çeşit cerrahi sırasında oluşan fasial sinir hasarı kesin olarak bilinmemesine karşın cerrahın bu bölgede sinir hasarı komplikasyonu olasılığı yüzünden baskı altında çalıştığı bir gerçektir. Fasial sinir monitörizasyonu için prob kullanımı operasyon süresini uzatabilmekte ve kullanım zorluğundan ötürü cihazdan alınan faydayı azaltabilmektedir. Prob yerine dril veya diğer cerrahi aletlere takılarak aynı anda hem cerrahi hem fasial sinir monitörizasyonu yapabilmeye olanak sağlayan adaptör, kulak ve parotis cerrahisi esnasında kullanıldı. Bu adaptörün kullanım kolaylığının yanı sıra cerrahi süreyi kısalttığı ve güvenli bir çalışma ortamı oluşturduğu görüldü.

**Anahtar Sözcükler:** Fasial sinir, monitörizasyon, kulak hastalıkları, cerrahi.

## Abstract

The damage of facial nerve during ear and parotid surgery is an undesirable situation for both the surgeon and the patient. Although the incidence of facial nerve damage in this type of surgery is not precisely known, it is a fact that the surgical operations in this area are risky because of the possibility of facial nerve damage. Use of probes for facial nerve monitoring could extend the operation time, and difficulties arising from their usage could lessen the benefits of this device. An adapter which could be connected to a drill or another surgical instrument instead of a probe, which enabled the surgery and facial nerve monitoring at the same time, was used in the surgery of ear and parotid. Apart from the ease of usage, this adapter also shortened the operation period and, thus, provided a safer working ambient.

**Key Words:** Facial nerve, monitoring, ear diseases, surgery.

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## Introduction

It is well-known that the use of facial monitor during ear and parotid surgery decreases the possibility of iatrogenic facial nerve damage. In the facial monitoring technique used during an acoustic neuroma surgery in 1960's, an assistant had to feel the facial contractions manually when a nerve was stimulated.<sup>1</sup> Handy-facial stimulators supplying continuous direct current and operating on a single-use battery have been used in this practice recently. Facial nerve damage related to these types of stimulators has also been reported. Being not sensitive enough, the device with facial sensor si-

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milar to today's stimulators developed by Jako<sup>2</sup> in the same period did not become popular. In the late 70's, on the other hand, the use of electromyography has been reported. The device developed by Jako was further improved by Silverstein who added an ultra-sensitive motion sensor and a stimulation probe to the device.<sup>3</sup> In 1989, the same researcher introduced an adapter capable of supplying continuous electrical stimulation and suitable for use with microsurgery devices.<sup>4</sup>

### Materials and Methods

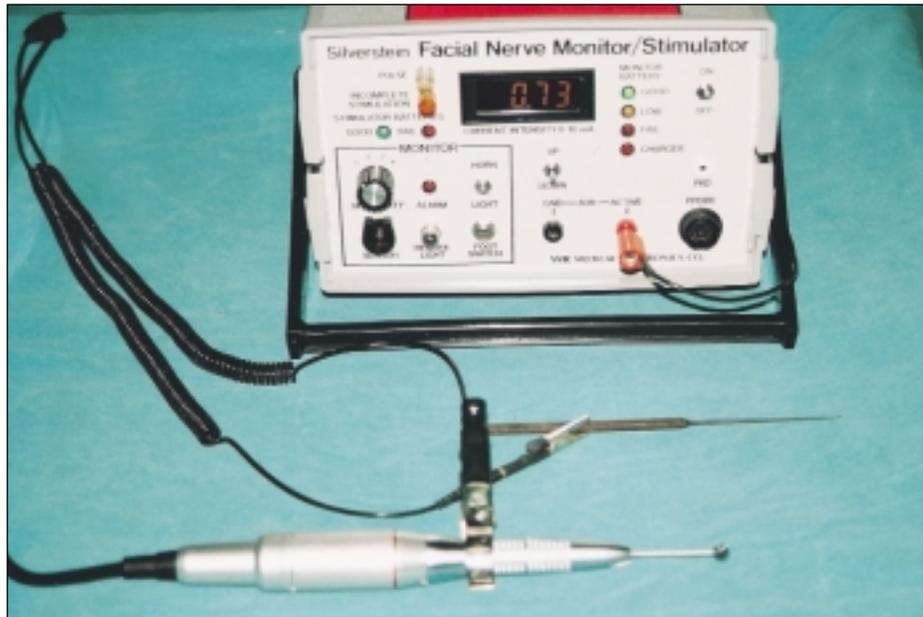
The Silverstein WR-S8 Facial Nerve Monitor Stimulator was used in the surgeries of 78 otologic and 13 parotid cases. Among the otological surgeries, there were 32 mastoid tympanoplasty, 41 tympanoplasty and 5 stapedectomy cases. The probe was used in 42 of the all cases for facial stimulation while an adapter capable of continuous stimulation in the rest of the cases. Before starting the operation, a sensor sensitive to muscular contractions was placed at the same edge of the mouth. The sensor warned the surgeon either by a light or a sound alarm thus, the orbicularis oris muscle was able to perceive. A wire was fastened to the shoulder of the patient by a self-sticking pad to earth the electrical load (Figure 1). A separate cable in the surgery site and a probe were used for the probe stimulation. This provided the stimulation of the facial nerve under various currents. In the use of continuous stimulation adapter, on the other hand, a hemostat - dissector was connected to the adapter clips for the parotid surgery (Figure 2). During the surgery of the ear, a drill was connected to one of the adapter's clip and a microsurgery device to the other clip (Figure 3). The current was adjusted at 5 mA in the sections distant from the facial nerve. It was decreased up to 0.1 mA while getting closer to the facial nerve. During ear surgery uplift of the bone bridge, lowering of the facial ridge and cleaning the perifacial mastoid cells were all performed by means of this device. In the parotid surgery when the cases had tumors especially extending towards the posteroinferior, the surgeon took the advantage of the device to expose the main trunk of the facial nerve.



Figure 1. Proper placement of strain-gauge sensor in mouth.



Figure 2. A hemostat-dissector was connected to the adapter clips for the parotid surgery.



**Figure 3.** A drill was connected to one of the adapter's clip and a microsurgery device to the other clip.

## Results

The Silverstein WR-S8 Facial Nerve Monitor Stimulator was used on all 91 patients in this study. A continuous stimulation adapter was used in 49 of the cases during the operation. Although it was necessary to interrupt the surgical operation to stimulate the facial nerve during the surgery with probe the surgical operation and monitorization of the facial nerve were simultaneously accomplished in case of the use of a continuous stimulation adapter. Because of this, the operation time extended in cases where the stimulator monitor was used for the first time in association with inexperience of the staff. However, in the subsequent operations, especially in cases where a continuous stimulation adapter was used, the operation time did not extend; on the contrary, it enabled a fast and reliable working facility. During the use of facial nerve stimulator in a case, a problem with device charging was encountered. In another case, some long-acting muscle relaxants were applied due to the change of anesthesia staff and the device was out of use within this period. No postoperative facial paresis or paralysis related to electrical stimulation was encountered in the cases.

## Discussion

Although iatrogenic facial paralysis during ear surgery has been reported to change between 0.6% and 3.6%, the rate of facial weakness in parotid surgery changed between 13% and 62.3%.<sup>5,6</sup> Such facial paresis or paralysis, which are likely to be encountered, is not a desirable situation both for the surgeon and the patient. It is also a medicolegal problem.

Although most surgeons suggest that the practicing surgeons should apply the facial monitorization routinely to all patients in the hospitals where residents were included, this is not true for experienced surgeons. There exists a broad consensus among the surgeons on the use of facial stimulator for the repair of internal auditory canal, cerebello-pontine angle and cranial base tumors, vestibular neurectomy, congenital aural atresia.<sup>5</sup>

Though the use of facial nerve stimulator during surgery has been reported to decrease the possibility of facial nerve damage, extended operation time due to the technical difficulties and inexperience of the operation room staff is a handicap of this device. Necessary interruption for facial stimulation of the nerve also decreases the efficacy of this

device. Therefore, the continuous warning adapter WR-S8 Facial Nerve Stimulator/Monitor developed by Silverstein could be used, and it enables facial monitoring without interrupting the operation.

Except for the first cases of 91 surgical procedures where the Silverstein WR-S8 Facial Nerve Stimulator/Monitor was used, it was observed that the operation time did not extend but decreased during the operation of the cases where a continuous stimulation adapter was used. There was no facial paresis or paralysis in our cases. In the studies of Terrell<sup>6</sup> where the parotid surgery series are very large, it has been reported that the use of uninterrupted facial monitorization decreased the rate of paresis significantly.

Silverstein reported the lamella thickness of the bone on the facial nerve as 1 mm when an electrical current of 1 mA was sufficient to stimulate the facial nerve. In practice, a current of 1 mA refers to approximately 1 mm of the bone thickness. This feature is an important point to identify the facial nerve and thin the bone lamella on it.<sup>1</sup>

All authors are of the same opinion that even the most successful facial monitorization conditions are not equal to the fundamental surgical techniques and are less important than not knowing the course of the facial nerve in the temporal bone. Authors also agree that lack of a monitorization procedure is rather more preferable to a misconducted facial monitorization.<sup>1,3,4,5,7</sup>

In conclusion, the benefits of continuous warning monitorization of intraoperative facial nerve may be listed as:

1. Enabling a reliable operation condition by shortening the surgery time,
2. Early identification of the facial nerve in the soft tissue, bone or tumor,
3. Warning the surgeon in case of an unexpected facial stimulation,
4. Identification of the facial nerve exhibiting anatomic variation or displaced by tumors.

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