Dental Treatment Effect on Deep Brain Stimulation System in Parkinson’s Disease

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Abstract

Parkinson’s disease (PD) is a highly prevalent, long-term neurodegenerative disorder that is sometimes treated by deep brain stimulation (DBS), which significantly reduces the need for dopaminergic drug therapy and improves quality of life. Such patients are cautioned, however, that dental instruments such as a dental turbine or ultrasonic scaler may adversely affect the functioning of such a system. Here, we report dental treatment for right maxillary tooth pain in a 65-year-old woman undergoing DBS for PD. The diagnosis was occlusal trauma. After verification with occluding paper each time, treatment comprised milling of the high contact points of tooth #17, followed by scaling with an ultrasonic scaler. This treatment was spread out over 3 visits, and its course was uneventful. To our knowledge, there are no previous reports on the interaction between dental instruments and DBS systems. Although no interference with the DBS system was observed here, we believe that the dentist should be aware of the potential for such, especially with the use of devices used to measure root canal length, dental lasers, and electrical scalpels.

Key words: Parkinson’s disease — Deep brain stimulation — Dental treatment

Introduction

Parkinson’s disease (PD) is a long-term, neurodegenerative brain disorder primarily characterized by motor dysfunction. Its prevalence is set to increase as more people enter the sixth and seventh decade of life. Early symptoms include shaking, rigidity, slowness of movement, and difficulty walking. This constellation of symptoms, described as “Parkinsonism”, results from dopaminergic cell death in the substantia nigra. It is estimated that currently there are approximately 100,000 cases of PD in Japan. As the Japanese
population ages, however, this number is expected to rise dramatically. There is no cure for PD, but the symptoms can be mitigated with levodopa or other pharmacological dopamine agonists\(^1\). As the disease progresses, however, pharmacotherapy becomes less effective, and dopamine agonists have to be prescribed in increasing amounts to remain effective, despite the potentially severe side effects of long-term use at such high doses.

Some studies have reported surgical implantation of microelectrodes for deep brain stimulation (DBS) to be effective as second-line treatment for PD\(^8\). This technology is vulnerable to electromagnetic interference, however\(^2\), and mobile phones and security gates produce electromagnetic fields that can interfere with its function. Recipients of DBS are informed that caution should be taken in accepting dental treatment involving use of a dental turbine (drill) or ultrasonic scaler\(^1\), two of the most commonly used instruments in such work. For both dentists and patients alike, therefore, it is important to know whether typical dental treatments are safe for use in the presence of a DBS system, or whether special precautions must be taken in such cases. To our knowledge, however, no studies to date have clearly determined whether dental machinery can affect the functioning of DBS systems. The purpose of the present paper, therefore, is to describe a case of a PD patient with a DBS implant who underwent dental drilling and ultrasonic scaling.

**Case Presentation**

Written informed consent was obtained from the patient for inclusion in this case report. The patient was a 65-year-old woman who presented at our clinic on March, 2017, with the chief complaint of tooth pain in the right maxilla. Her medical history revealed that she had developed the symptoms of PD at the age of 49 years, with pharmacological treatment of the disease commencing at the age of 54 years. By the age of 62 years, however, she was taking the maximum allowable amount of levodopa and had developed dyskinesia, a severe motoric side effect of anti-PD drugs. At this point, she agreed to the placement of a DBS system (Activa\(^\copyright\); Medtronic, MN, USA). The procedure was successful and reduced the need for levodopa, improving both the dyskinesia and quality of life. Her Hoehn and Yahr Scale score indicated stage-3 PD, and she had no eating disorder or dysphagia. Two years before arriving at our clinic, however, she experienced interference with the DBS system from a local security gate. Knowing that dental equipment might also cause such interference, she was reluctant to undergo dental treatment, even though she was experiencing oral discomfort. Finally, however, mastication became difficult due to tooth pain, which resulted in undereating. At this point, the pain had become unbearable, and she sought out dental care.

Apart from the PD and oral problems, her medical history revealed no other disease or abnormal systemic findings. An oral examination showed a mild dental calculus adhesion and tooth separation in the anterior region (Fig. 1). The degree of oral cavity cleaning was good. An examination revealed no obvious caries and only mild periodontitis, with 2–3 mm periodontal pockets. Of all the teeth, only #17 was found to exhibit pain on percus-
sion, but not on exposure to heat or cold; moreover, no mobility was observed in this tooth. The patient’s history showed that this tooth had been treated with a prosthesis 20 years earlier, although she had only begun to experience pain on occlusion 6 months earlier.

A portable X-ray imaging system (Dexco ADX4000W®, Dexcowin, Pasadena, CA, USA) (Fig. 2) was used to obtain radiographs, which also showed negative findings for caries and severe periodontitis. A slight expansion of the periodontal ligament space was observed, however.

Further examination revealed high occlusal points for tooth #17, leading to a diagnosis of tooth pain due to occlusal trauma.

**Clinical Procedures and Outcomes**

The neurosurgeon in charge of her case and the manufacturer of the DBS system were first consulted with respect to the feasibility of using a dental turbine and ultrasonic scaler in treating this patient. Subsequently, we were advised to monitor the operation of her DBS system via her on/off switch throughout the treatment process (Fig. 3). The system was determined to be functioning normally when the patient became dyskinetic 15 minutes after it had been turned off. This particular DBS system utilizes a stimulating electrode in the subthalamic nucleus. Again, we had been advised on the potential risks of different imaging modalities, and had been informed that while X-rays and CT imaging posed no threat to the DBS system, MRI was out of the question. After an explanation on the safety of the appropriate treatment and its potential effect on the DBS system, X-ray images were obtained.

All treatments were performed at the patient’s home. The high occlusal points of tooth #17 were milled (Viva Mate G5®; NSK, Tokyo, Japan) after being checked with occluding paper. The milling procedure was spread out over 3 sessions. The operation of the DBS system was checked within 15 minutes following each session by monitoring the on/off switch and pain confirmed to have improved. Only the points of high occlusion were milled, followed by full-jaw scaling with an ultrasonic scaler (Portable Unit N3®; Yoshida, Tokyo, Japan) at a frequency of 29 kHz and amplitude of 100 μm. No hand scaler was used as no fixed point could be obtained due to dyskinesia.

To minimize the danger of the equipment interfering with the DBS system, the following distances were maintained between compo-
ponents: approximately 6 cm to the extension cord; approximately 25 cm to the patient programmer; and approximately 15 cm to the electrodes. Treatment time was restricted to no more than 20 minutes as her Parkinsonian symptoms began to re-appear when the DBS system was shut off for longer than that.

The patient’s tooth pain responded completely to the milling. The patient immediately started eating more, and was able to chew even the crunchiest food without pain. During both procedures, the DBS system functioned normally. Her tooth pain did not recur and the clinical course was good; additionally, her anxiety regarding dental treatment was eliminated, and she began having regular dental checkups.

Discussion

The internal nature of DBS equipment makes it difficult to judge whether or not a patient has had such a procedure without an explicit declaration. If the present patient had not stated that she had received a DBS implant, it might have been assumed that she only had mild PD. Therefore, it is important for the dentist to be aware of the treatment status of PD patients, especially where a DBS implant has been used, as involuntary, dyskinetic movement of the tongue or face will intensify if the DBS system is off or not working correctly.

Some studies have reported that use of electrocardiography or electrical scalpels caused abnormalities in DBS systems. Dental instruments likely to interact negatively with such systems include those used to measure root canal length, dental lasers, and electrical scalpels. These instruments all create a strong electromagnetic field in or very near to the patient’s body. For cases in which these instruments are needed, dentists should consult with the patient’s primary physician (or neurologist) to ensure that there will be no adverse interactions, thus ensuring patient safety. Moreover, such systems are not only used in PD, but in a number of other neurological diseases as well. Therefore, individual differences may need to be accounted for.

To the best of our knowledge, there are no reports detailing potential interactions between dental instruments and DBS systems. Awareness of DBS is still low. The delicate nature of DBS systems and fine-tuning required for the stimulation protocols to work properly mean that this needs to change, with a move to increase awareness among healthcare workers in other fields, in particular. Furthermore, there is a distinct need for further study on medical practices and equipment that might adversely affect the working of such systems. In the present case, communication could be maintained with the patient throughout the course of treatment. Difficulty of voluntary movement in PD patients frequently interferes with speech, however, potentially preventing effective communication. In such cases, it is essential that the dentist be able to monitor the functioning of the DBS system and be ready to switch it back on should it malfunction. Additionally, the dentist will need to frequently check on the patient’s general condition during treatment and take care to limit treatment time to prevent Parkinsonian symptoms from becoming severe.

Conflict of Interest

The authors wish to declare no conflict of interest.

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