

Treatment of Bruxism with an Active Mouthguard

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Project partner: Financial support: INVENTUS BERN – Stiftung

Bruxism is characterized by the subconscious and nonfunctional grinding or clenching of the teeth.

Bruxism often results in abnormal wear patterns of the teeth and over time, dental damage will occur.

Bruxism is an uncontrolled habitual behavior and one of the most common sleep disorders.

Studies have shown that about 5 % of the US population develop symptoms severe enough to have a mouthguard made by a dentist. A mouthguard out of hard acrylic is a standard treatment to reduce tooth wear.

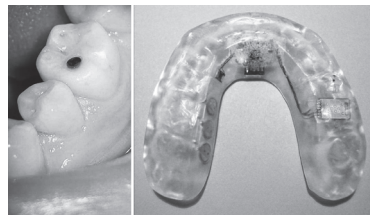
Besides the mouthguard, another but seldom used treatment is the biofeedback method. In this method electrodes are placed on the masseter or temporal muscle and connected to a monitoring device which produces a sound whenever a muscle activity is detected. For short term use these devices seem to decrease bruxing time efficiently. Unfortunately the electrodes and their wires are uncomfortable and one can get used to the sound, and the effect decreases.

The aim of this project was to develop a mouthguard that incorporates an electronic device to measure and radio transmit the interocclusal distance and the sagittal and transversal mandibular displacement. Based on these real time data, an electrical stimulation could be produced and applied as feedback upon tooth-mouthguard contact.

Project Scope

A tiny magnet was encapsulated in titanium and embedded in a tooth filling preexisting on the occlusal surface of a molar.

Two tiny electronic circuit boards have been developed to be encapsulated in the mouthguard, a transmitter board and a sensor board.



Encapsulated magnet in molar / Active mouthguard with sensor and transmitter electronic and batteries

The sensors on the sensor board are read out four times a second by the transmitter board, which radio transmits the data to a receiver connected to a laptop. Depending on the sensor's measured field strengths, the magnet's position can be determined.

The electronic is powered by batteries that can be recharged via electromagnetic field (slit torus coil).

Results

With a Matlab program, data of a whole night with characteristic sleep phases can be analyzed. First measurements of 8 nights with and without biofeedback resulted in a highly significant reduction of tooth-mouthguard contact.

Discussion

Our measurements show grinding activities during short sleep phases as reported in several studies. The new mouthguard offers additional variables like position and speed to define conditions upon which bruxing events are detected. The hardest and still unsolved technical problem of the project is the fast degrading of the rechargeable batteries. They only lasted for 3 months.

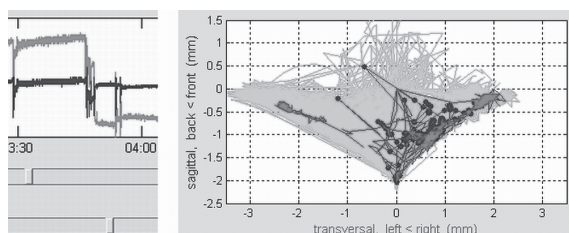
Clinical research would have to prove the safe operation, long term effectiveness and further effects of a stimulation on the users sleep hygiene and mental health.



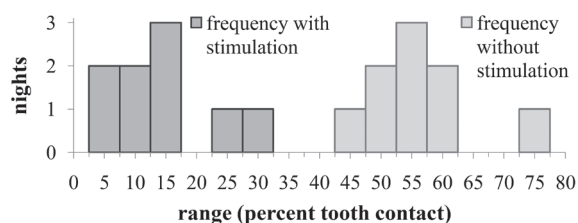
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A timeslot of interest and its sagittal versus transversal movement plot redrawn in red



Measurements of 8 nights with and without biofeedback