

More effective device for patients suffering from temporomandibular joint disorder

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Function: Temporomandibular joint disorder, or TMJ disorder, encompasses both acute and chronic inflammation of the temporomandibular joint, which connects the mandible to the skull. Currently, patients with chronic and severe TMJ disorder use bite guards or bite plates. These devices help relieve pain but mainly serve to protect the teeth. However, these devices have proven to be ineffective since patients with bruxism clench and/or grind their teeth on the bite guards, resulting in chronic pain and inflammation due to increasing pressure on the joint and strain on the jaw and neck muscles. The purpose of this project is to develop a better night and/or day-time device for TMJ patients that keeps the jaw more relaxed, particularly during long periods (i.e. during sleep).

Client requirements:

- Alleviate muscle soreness that results from TMJ
- Durable and easy to clean
- Stays in place for full night's sleep
- Turning on and off at time intervals that would be effective and still conducive to the client's sleep
- Provides a high degree of comfort

Design requirements:

1. Physical and Operational Characteristics

- Performance requirements:* The device should be able to be worn on a daily basis for 8-10 hour periods. It should be easy for the client to put on and remove easily and fit comfortably on the head without causing discomfort no matter what sleeping position the client uses.
- Safety:* The material used for the device should be safe for the client to have on her head for extended periods of time. The device should be built in a manner to minimize the risk of strangulation by the device and its attached power cord.
- Accuracy and Reliability:* A high level of accuracy is not too necessary, since the fit should be adjustable. However, the massaging device should be accurate enough to target the key muscles and jaw areas to be effective. The electrical components need to have a high level of accuracy to give the correct amount of power without breaking down or short-circuiting. Also, the device should only consume a reasonable amount of power since it will be used on a nightly basis. Since this product will be used every night, it needs to have a high level of reliability.
- Life in Service:* The device should be durable enough to withstand 8-10 hours of use daily for 10 years.
- Shelf Life:* This device is custom made so it will not have a shelf life. After it is created, the client will begin using the device immediately.
- Operating Environment:* The device should endure a storage temperature range of -20°C to 45 °C, and operate in a temperature range of 0°C to 35°C. The outer fabric of the device should be machine-washable.
- Ergonomics:* Client should easily be able to put the device on her head and strap it by herself. Also, it should not impede the client's sleep during the night.
- Size:* The device should be adjustable, but the size of the device should be able to fit the client's head. The massagers and microcontroller should be no larger than 8 centimeters wide.
- Weight:* The device should not exceed 500 g.
- Materials:* The strap should be nylon, with the adjustable component being buckle-like. The device will also consist of an Arduino microcontroller and the massaging and heating components.
- Aesthetics, Appearance, and Finish:* The device should be soft enough to not irritate the client's skin. The Shiatsu massager shouldn't cause discomfort.

2. Production Characteristics

- Quantity:* One device per client.

b. *Target Product Cost*: There are no current devices, but the budget is about \$100.

3. Miscellaneous

a. *Standards and Specifications*: FDA approval is not required by the client.

b. *Customer*: The client is willing to try any solution that will provide pain relief.

c. *Patient-related concerns*: The device should be easy to clean whenever necessary.

d. *Competition*: There are no devices on the market. However the client could see a masseuse to have the same task accomplished.