

Letters

RESEARCH LETTER

Development of a Tongue-Piercing Method for Use With Assistive Technology

Piercing the tongue for wearing jewelry is not infrequent among young adults.^{1,2} The procedure is not usually performed by medical personnel. A new assistive technology for people with tetraplegia, the Tongue Drive System (TDS), utilizes voluntary tongue movements for control.³ The operator uses a magnet attached to the tongue together with an externally mounted sensor array that detects changes in the magnetic field to drive powered wheelchairs and access computers.⁴ We hypothesized that a magnet-containing barbell would provide a semipermanent means of attaching the magnet to the tongue. Our aims were to design a medically appropriate tongue-piercing method and to confirm that using a magnet-containing tongue barbell works to control the TDS.

Methods | After reviewing the scientific and trade literature, discussing with dentists, oral surgeons, and otolaryngologists, and observing community piercers, we developed a tongue-piercing protocol and refined it during implementation. Each participant underwent tongue piercing and placement of a magnet-containing barbell (Box 1). Five half-day testing sessions using the TDS to drive a powered wheelchair and perform computer tasks were performed. The study was approved by the Northwestern University institutional review board. All participants gave written consent before any study activities were started.

Results | Ten healthy adults were screened for normal tongue mobility and adequate intraoral space. Three were ineligible because of a short lingual frenulum (ankyloglossia). The tongues of 7 individuals (6 women, 1 man) were pierced and a stainless steel 316 LVM internally threaded tongue barbell inserted in each. One participant removed the barbell and exited the study 48 hours after piercing as a result of swelling and discomfort.

Mean (range) pain scores, rated on a 0 to 10 scale, were 5.8 (1-8) on day 1, 4.0 (1-7) on day 2, and 2.9 (1-5) on day 3. Boley gauge (a type of caliper) measurements and plethysmography revealed increased tongue dimensions and decreased intraoral volume, respectively, on day 1, but these measurements returned to baseline by week 4. Drooling and difficulty swallowing, eating, and speaking were noted by most participants on day 1. The incidence and severity decreased by day 3. Calculus developed on the ventral ball of the barbell in all participants by week 4.

During a 6-week period, all 6 remaining participants completed at least 2 TDS testing sessions, and 4 of the 6

Box 1. Tongue-Piercing Protocol

1. Brush teeth with a soft toothbrush and toothpaste
2. Swish and spit for 30 to 60 seconds with chlorhexidine gluconate, 0.12%, mouthwash
3. Pat tongue dry with sterile gauze and gently grasp with sponge (Foerster) clamp
4. Mark piercing location with sterile marker pen at the midline, approximately one-third of the way back from tip, and anterior to frenulum
5. Inject 2 to 3 mL of bupivacaine hydrochloride with epinephrine 1:200,000 (as bitartrate) along and around expected piercing tract; wait at least 5 minutes
6. Pierce dorsal surface of tongue with 12-gauge hollow-bore piercing needle and advance dorsoventrally through the tongue
7. Embed inferior end of needle into cork
8. Align the shaft of the barbell (stainless steel 316 LVM internally threaded) with the blunt end of the piercing needle
9. Using the barbell, push the piercing needle through the tongue and allow to fall into cup held under tongue
10. Screw inferior ball tightly onto barbell
11. Remove clamp
12. After at least 4 weeks exchange the initial barbell for a shorter barbell^a

^a In all participants, a titanium barbell with a magnet in the dorsal ball was placed for use with the TDS.

completed 5 TDS testing sessions. All 6 participants were able to operate the TDS effectively.

Discussion | Thirty percent of candidates were ineligible to participate because of motion-limiting ankyloglossia. In the future, frenotomies in people with tetraplegia to allow operation of authenticated tongue-based assistive technologies may be justifiable. Only internally threaded barbells were used in order to avoid tearing tongue muscle on insertion. Nickel hypersensitivity was avoided by using initial barbells expected to release less than 0.2 $\mu\text{g}/\text{cm}^2/\text{wk}$ of nickel.⁵ During the second phase, the rare earth metal magnet was completely encased in a titanium barbell.

Boley gauge measurements helped determine the lengths of barbell shafts on the basis of tongue thickness allowing for 6.35-mm swelling. Plethysmography data confirmed tongue swelling but less than expected. We attribute this to strict adherence to detailed aftercare instructions (Box 2). The use of chlorhexidine gluconate mouthwash for the first week and ongoing use of an antiplaque mouthwash may have helped prevent early infections.⁶ However, the appearance of lower ball calculus after only 4 weeks of wear underlines the importance of assiduous cleaning of barbells. Proximal placement of barbells was done to prevent gum and tooth damage. The TDS was operated effectively from this position.

Box 2. Tongue-Piercing Aftercare Instructions

Care for Your Pierced Tongue

Brush teeth with soft brush and toothpaste after each meal and before bed

Rinse mouth with chlorhexidine antibacterial mouthwash after each meal and before bed

Gently paint jewelry with brush dipped in chlorhexidine antibacterial mouthwash after each meal and before bed

After 1 week stop using the chlorhexidine mouthwash and use an alcohol-free antiplaque formula mouthwash to rinse the mouth and clean jewelry

To prevent plaque formation and ensure the ability to remove the barbell when necessary, continue the above care for as long as you wear piercing jewelry

Things to Do

REST YOUR TONGUE

To minimize pain and swelling, sip cold water or suck on chipped or shaved ice

For additional pain control take oral acetaminophen as needed

Eat slowly and take small bites

Place bites of solid food between molars to avoid using your tongue

Eat cold, soft foods such as smoothies, shakes, ice cream

Thoroughly wash hands before touching jewelry and surrounding area

Check the security of your jewelry each night by checking the ball on the underside of your tongue: loosen and then tighten it. This is important to ensure the ability to remove the barbell in case of need and to prevent inhalation or swallowing of any part of the jewelry

Things Not to Do

For the first 2 days:

Do not stretch or bend your tongue

Talk as little as possible

For the first 7 days:

No anti-inflammatory medications such as ibuprofen, naproxen, or aspirin

No foods that are sticky in the mouth such as gum, candy, peanut butter, mashed potatoes, oatmeal

No salty, spicy, acidic, or hot foods and beverages

No sucking on straws

For the first 4 weeks:

No smoking or chewing tobacco

No dental work

No tongue kissing or oral sexual contact even with barrier protection

For the duration of wearing piercing jewelry:

No rotating or playing with tongue jewelry

No harsh or alcohol-containing mouthwash

Do not chew on hard objects, eg, pens, utensils, sunglasses, fingernails

Study limitations include the small number of participants, the exclusion of those with chronic conditions that might have delayed wound healing, and the variability of tongue thickness measurements because dimensions changed depending on the position and degree of tongue protrusion.

In conclusion, a medically appropriate tongue-piercing protocol was developed. It was used to place a magnet-containing barbell that effectively operated the TDS.

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