

Title: Mouthstick to facilitate a quadriplegic's use of a computer keyboard.

Function (a general statement of what the device is supposed to do): The function of the new design will allow for a quadriplegic patient to more easily use a computer keyboard without causing wearing or chipping of the teeth.

Client requirements (itemize what you have learned from the client about his / her needs):

Design requirements:

1. Physical and Operational Characteristics

a. *Performance requirements:*

- Used for 1-2 hours at a time
- Maneuver/hold the stick with only a small amount of pressure applied by the mouth
- Press the keys on the keyboard using only force from movement of jaw and not applied by neck.
- Stick should move in and out of the mouth without the mouthpiece grinding across teeth.

b. *Safety:*

- Made of non-toxic material (e.g. hard-soft acrylic)
- Must not contain any type of coating that could peel/chip off in the mouth.
- Not present a choking hazard (i.e. any parts of mouthpiece that could possibly break off or become detached should not be smaller than 3cm in diameter)
- Material that can be cleaned/sterilized and reused.

c. *Accuracy and Reliability:*

- Accuracy not applicable
- Not wear or degrade in shape from use in mouth

d. *Life in Service*: 3 years

e. *Shelf Life*: Product should have a ten year shelf life when stored at room temperature (18-26°C or 65-80°F) .

f. *Operating Environment*:

- Conducive to an oral environment. Temperature 95°F or 35°C. 100% salival humidity.
- Withstand forces from biting down ~150-250N (force values taken from experiments performed by Fall 2001 BME mouth guard for bruxism group) and force from falling.
- Should not shatter/crack if mouth stick is dropped from height of up to 2m.

g. *Ergonomics*:

- Held in the mouth when the mouth is relaxed.
- It must be lightweight
- Torque of mouthstick should not exceed 0.08 Nm.
- Angle between plane of mouth piece and stick should be 18° (angle needs to be adjusted for height of individual users)

h. *Size*:

- Mouthpiece:
 - Top piece: 4.9cm X 7cm and thinness varies
*because of the teeth indentations (~0.25 cm).
 - o Groove depth: varies* (~0.6 cm)
 - Bottom piece: 3.5cm X 5.8cm and thin (~0.25 cm).
 - o Groove depth: varies* (~0.9 cm)

-Total extension of top piece outside mouth: 3.25 cm

- Prototype: 2.4 cm
- Extension before sliding track: 0.75 cm
 - Prototype does not include this feature
- Sliding track: 2 cm
- Stoppers for sliding mechanism: 0.20 cm (2 stoppers)

- Length of "stick": 56cm (stick used for laptop computer) and 63 cm (used for desktop computer)

- Stick diameter .6 cm.

i. *Weight:*

"Stick"

Optimum weight – 28g (1 ounce) +/- 0.3 oz

Mouthpiece

Optimum weight – 57g (1 oz) +/- 0.5 oz

j. *Materials:*

- Lightweight but durable materials
- T6 aluminum alloy for the stick (arrow shafting)
- Hard-soft acrylic for the mouthpiece
- Vacuum-formed plastic

k. *Aesthetics, Appearance, and Finish:*

- Neutrally colored mouthpiece
- Bright, metallic colored stick
- Non-threatening appearance.

2. Production Characteristics

a. *Quantity:* 1

b. *Target Product Cost*: \$40-60 per mouthstick.

3. Miscellaneous

a. *Standards and Specifications*:

- FDA approval

b. *Customer*:

- Angle of stick relative to the mouthpiece is critical (angle needs to vary with height of person).
- The thickness of the current mouthstick is desired.
- Length of stick needs to vary for different tasks (i.e. using laptop computer vs. desktop).

c. *Patient-related concerns*:

- Current material is too hard.
- The way it is maneuvered in the mouth causes the mouthpiece to grind against the teeth causing wearing/chipping of the teeth and increased sensitivity in the teeth due to nerve exposure.

d. *Competition*: There are several other similar devices on the market.

- Sammons Preston: Bendable Telescopic Mouth Stick
- <http://www.wisdomking.com/line255.html>
- <http://www.abilityhub.com/mouse/joystick.htm>