Mechanical Nitinol Prosthetic Tongue

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Technology description

Background It is estimated that as many as 16.5 million US senior citizens may require care for dysphagia stemming from age, neurologic disease, or radiation and surgery. A substantial portion of these patients have oral or oropharyngeal based dysphagia, which affects up to 40% of patients 65 years or older. Many patients require supplemental feeding via a gastrostomy tube, often accompanied by medical complications and a short term decreased quality of life. Long term quality of life can be further reduced by gastrostomy dependence, malnutrition, aspiration pneumonia, and loss of physical and social pleasures experienced through eating. Estimated inpatient healthcare costs due to dysphagia exceed $547 million dollars per year. Current treatments for dysphagia include postural strategies, change in food bolus volume or viscosity, tonic muscle contraction techniques such as neuromuscular electro-stimulation, specific swallow maneuvers, surgery sensorial enhancement strategies, pharmacologic treatments, and gastrostomy tubes. Unfortunately, when these therapies fail, there is currently no device available that can replace lost swallow functionality. Technology The Tongue Prosthetic Assist Device (TPAD) is a novel, non-invasive dental device that assists patients who suffer from dysphagia, a difficulty in swallowing, or in the passage of solids or liquids from the mouth to the stomach. The TPAD mimics the movement of the native tongue, and exploits the vertical force produced through natural opening and closing of the jaws. The unique design of the prosthesis contains a braided nitinol lattice structure that bulges upward and posterior with the jaw closure, providing immediate mechanical force to propel the food bolus into the pharyngeal phase of swallowing. The prosthetic tongue was developed to exploit the vertical force produced through natural opening and closing of the jaws. This vertical force is redirected to compress the food bolus and propel it posteriorly, thus supplementing the swallow of a debilitated tongue. In the prototyping process a mouth guard was used as a structural skeleton for embedding modular segments.

The prosthetic tongue includes three primary components: 1) buttons that receive vertical force loading from the teeth and transfer the force to nitinol wires, 2) curved nitinol wires with an approximately orthogonal bend, 3) a nitinol latticework covered with polymer sheeting that transfers the force of the bulging wires to compress the food bolus. The device can be used to enhance swallowing rehabilitation as a temporary aid and/or can be used to permanently replace lost tongue functionality. The prosthesis has the potential to become a primary tool in the armamentarium of the clinician, in a field where very few tools exist to improve swallowing. The modest cost of the prosthesis

would be offset by prevention of hospitalizations for gastrostomy tube placement, consequences of malnutrition, and improvement in the quality of life of affected individuals.

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