

## What are the Most Important Areas of the Cortex and Sub-Cortex for Swallowing and How Can We Use this Information to Inform Dysphagia Rehabilitation in Stroke Patients?

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### Abstract

**Aims:** Identifying which brain areas are consistently activated during swallowing may help to plan evidenced based swallowing treatments. Only one Activation Likelihood Estimate (ALE) Meta-Analysis on swallowing has been published to date. This study conducted an updated ALE Meta-Analysis of saliva and water swallowing incorporating greater subject numbers and considers how this information can be used to inform treatments for post-stroke dysphagia.

**Methods:** Studies utilising functional Magnetic Resonance Imaging or H<sub>2</sub>O/FDG Positron Emission Topography were included. Coordinates from 14 studies (17 experiments, 188 participants, 300 foci) were entered onto the Brain Map Database. Results were displayed in Talairach Space. Within conditions and between conditions analysis was performed.

**Results:** The results confirm that each task activated different neural networks, but with overlapping regions. Regions activated in both conditions included the cingulate gyrus, sensorimotor cortex, inferior frontal gyrus and putamen. Saliva swallowing activated more motor areas (M1 and SMA), whereas water swallowing activated more sensory areas (S1 and insula). Insula activation, in keeping with previous findings, displayed anterior to posterior activity during water- and saliva swallowing tasks respectively.

**Conclusions:** These results provide further robust evidence as to which brain regions are consistently activated during saliva- and water swallowing. Furthermore, this information helps to signpost researchers to investigate and plan treatment methods that could stimulate these areas in dysphagia rehabilitation. Recently emerging neuro-stimulation approaches to treating dysphagia post-stroke (such as Air Pulse Stimulation) are examples of how this information can be used to inform dysphagia rehabilitation in stroke patients.

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