Structure and Function in the Human Jaw

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ABSTRACT
The lower jaw is a light, beam-like structure. When loaded by muscle tensions, it can bend parasagittally and laterally, and twist longitudinally. Its essentially-frictionless articulations with the skull normally work in compression while allowing condylar pitch, jaw, roll and translation. The upper part of the jaw motion envelope is constrained by dental contact, while the lower is shaped by active, and passive (viscoelastic) muscle tensions. While co-contraction can add significantly to the jaw’s stiffness, mandibular resting posture is likely maintained by both muscle thixotropy and some fluctuating, active tone. The masticatory muscles function differently than those in the limbs; the jaw closers are multipennated, spindle-innervated, and compartmentalized, whereas the openers are more parallel-fibred, devoid of spindles and are not compartmentalized. The closers function over shorter lengths than the openers. There are no reciprocal stretch reflexes. Jaw-opening and closing reflexes are brainstem-mediated, though longer-loop paths are probably involved in unloading reflexes. The brainstem is responsible for opening and closing reflex modulation during functional activity, and is also implicated in rhythm and pattern generation. Suprasegmental mechanisms include sites in the basal ganglia and motor cortex, and the system always produces bilateral descending drive. All normal jaw movements are strongly regulated by peripheral feedback from several sources, the periodontal innervation playing a particularly significant role regulating high dental forces. The pterygoid and temporal muscles are primary contributors to various postures and movements with horizontal components, though regions of the masseteric complex also function differentially during some tasks.

This presentation offers an overview of these features of the functioning jaw. Though much information can be derived from direct studies in humans, recent dynamic models are providing insight into variables that are difficult or impossible to measure in vivo, and these aspects are also addressed.