Jaw function
beyond the realm of dentistry

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Traditionally the jaw and its function or dysfuntion reminds us of “Dentists”

Jaw function and dysfunction

Normal function

Eating

Drinking

Chewing

Speech

Yawning

etc.…

Dysfunction

Temporomandibular disorder

(TMD)

TMD - Definition from dental literature

'TMD is a collective term embracing a number of clinical problems involving

- the jaw muscles,
- the temporomandibular joints and
- associated structures.

Common patient complaints include pain in the

- jaw, face, head, neck and ear regions.

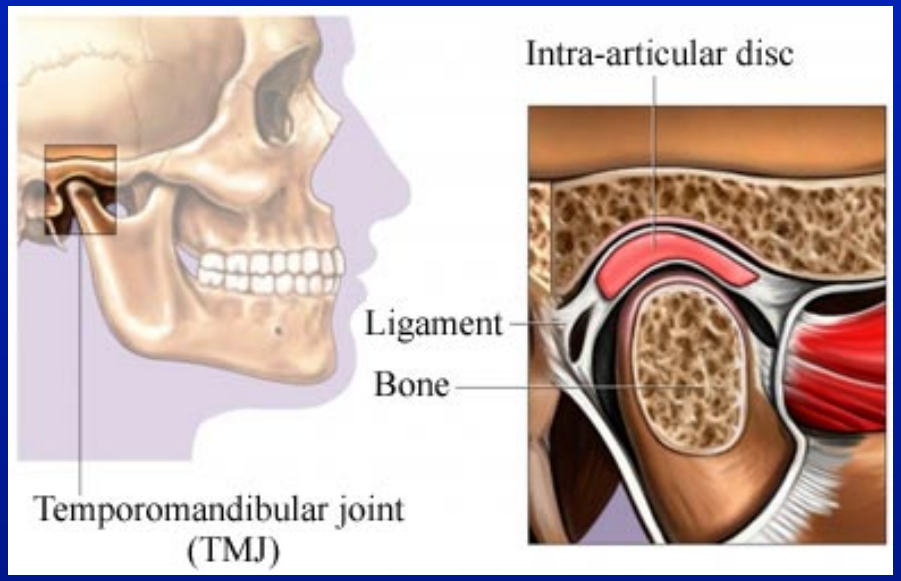
It is synonymous with 'craniomandibular disorders' (CMD)

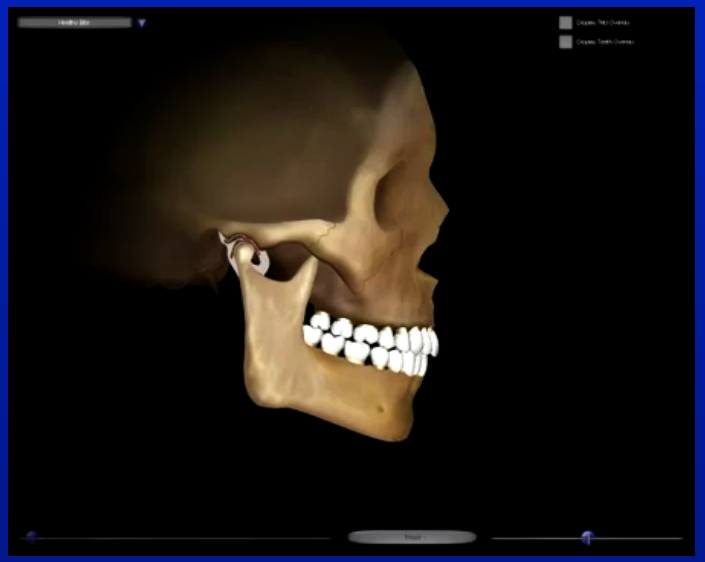
But is the

jaw function or dysfunction

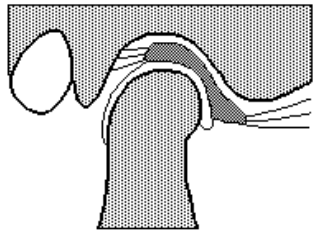
only related to dentistry?

Temporomandibular joint





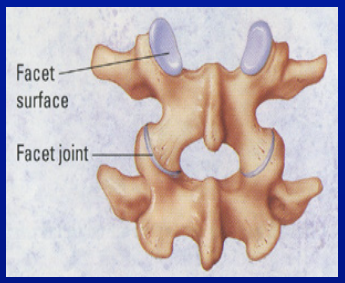
- Rotation
- Translation



Temporomandibular joint

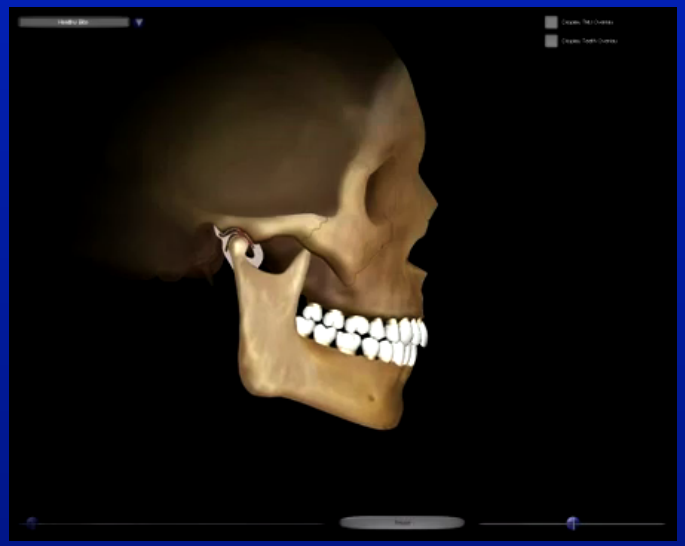
TMJs of both sides always function together.

Functionally, 2 TMJs are in fact, 2 parts of “ONE JOINT” with 4 joint spaces.



This makes it’s motor control very complex.

Mandibular movement during gaping
Text book knowledge !!



But is it true and complete picture?

In order to answer this question, we need to study the mandibular movements in details.

Human movement

Voluntary human movement is a direct reflection of mechanisms and strategies of the central nervous system.

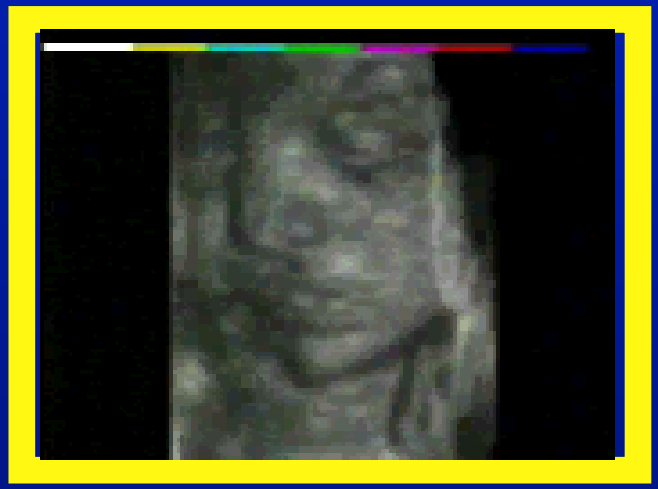
Movement analyses can thus serve as a window into the functioning of the central nervous system with regard to motor control.

Mandibular movement during gaping

As a basis for evaluation and treatment of movement disorders,

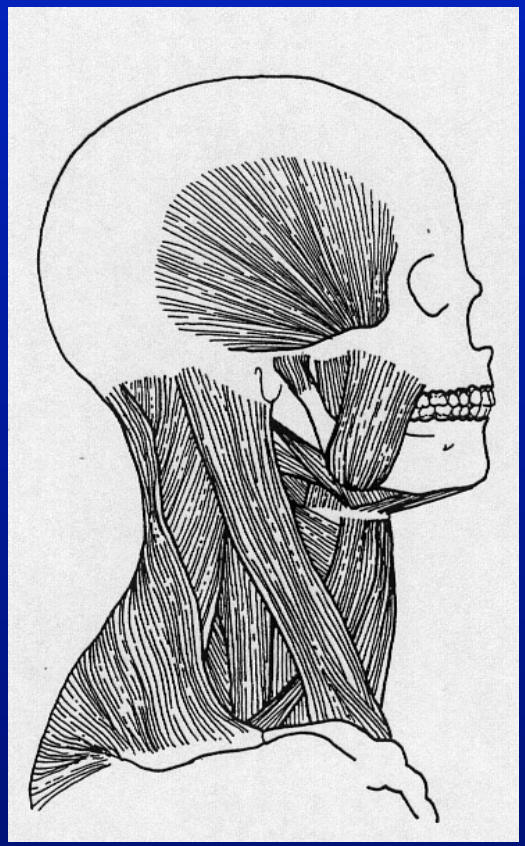
we need to know about "normal" movement patterns in order to understand "pathological" movement patterns.

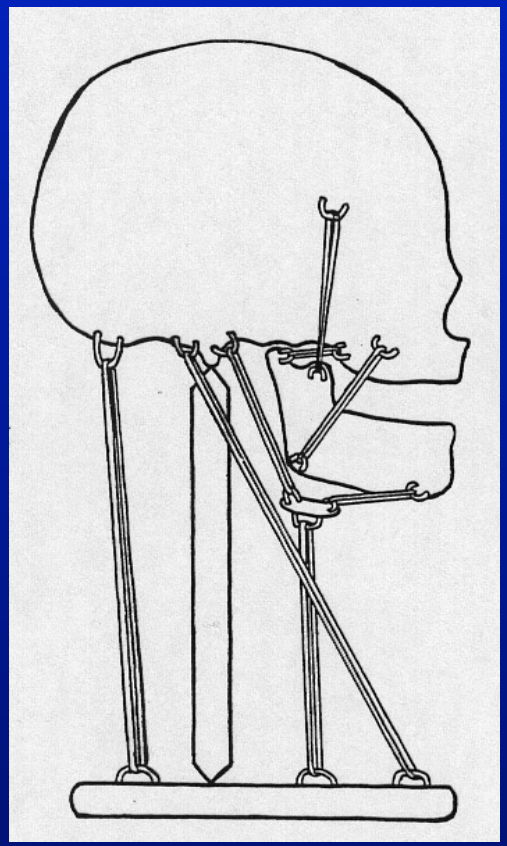
Innate behaviour
Fetal yawning

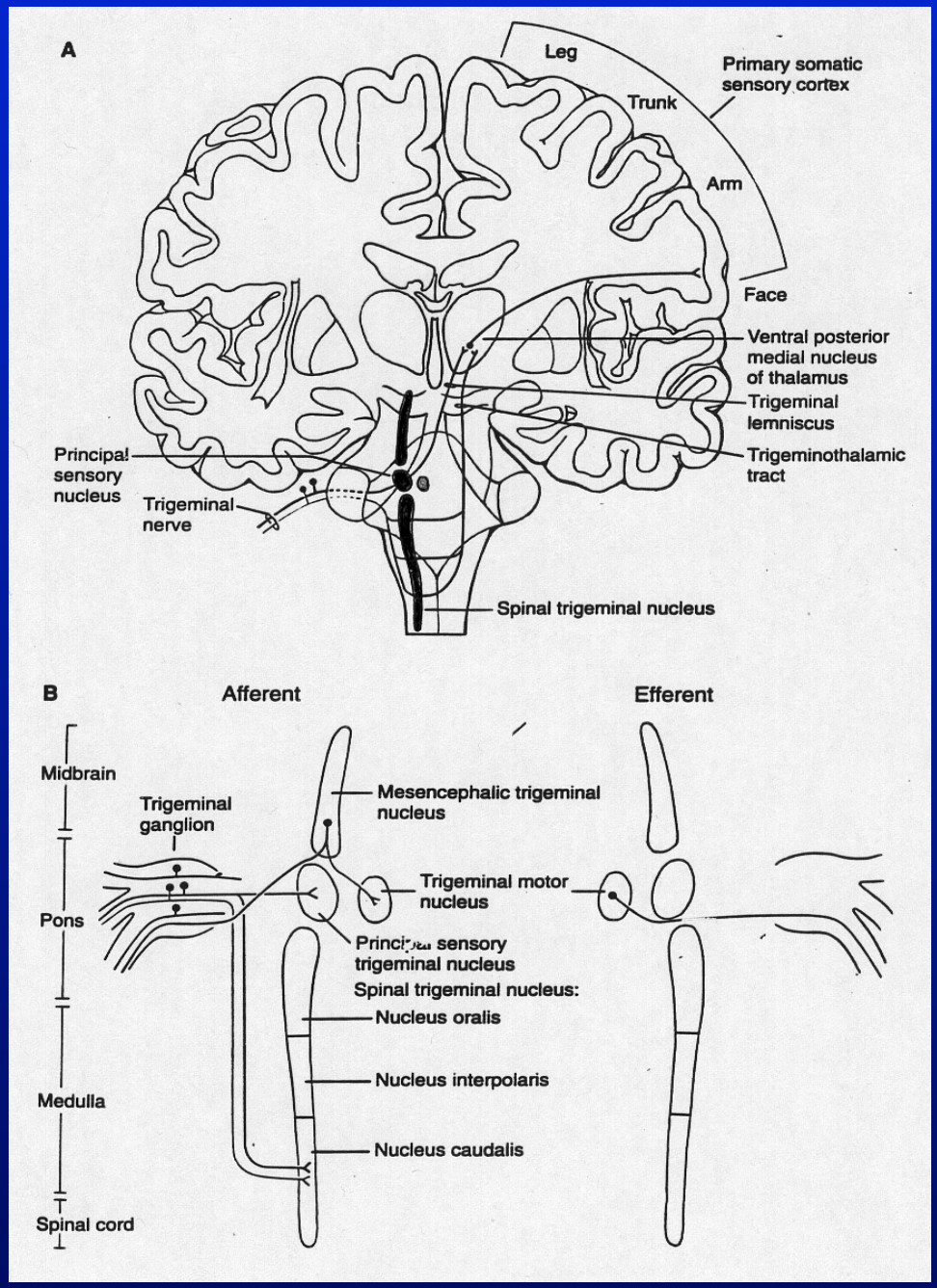


24 w

Biomechanical linkage between jaw and head-neck

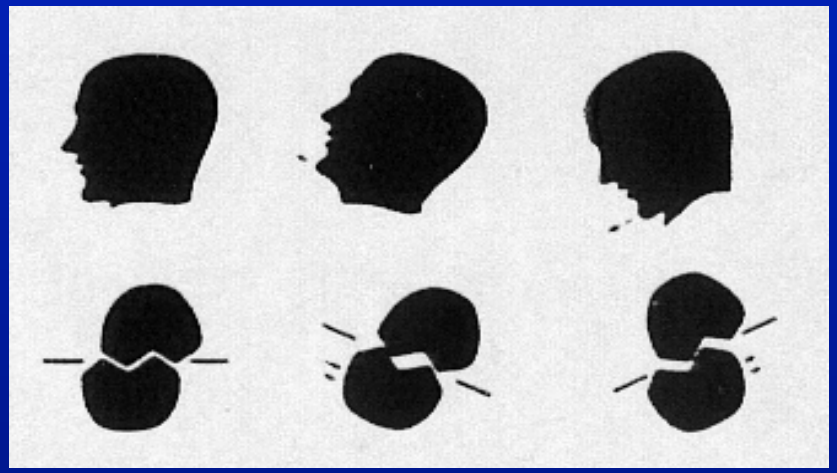




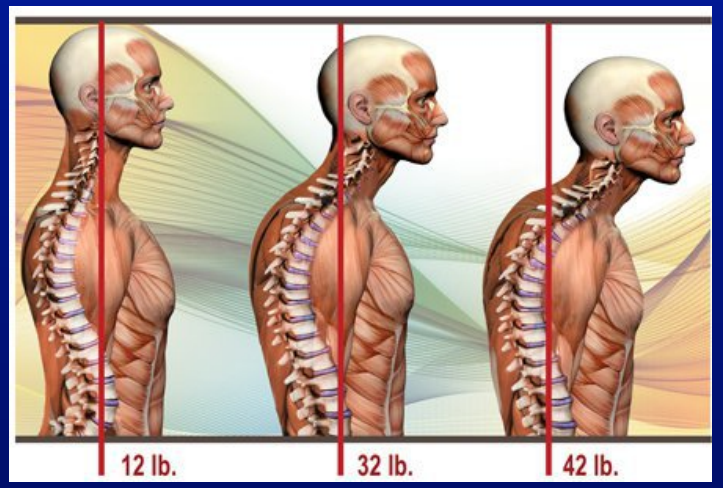


Trigeminal nerve nuclei

Effect of head-neck position on dental occlusion

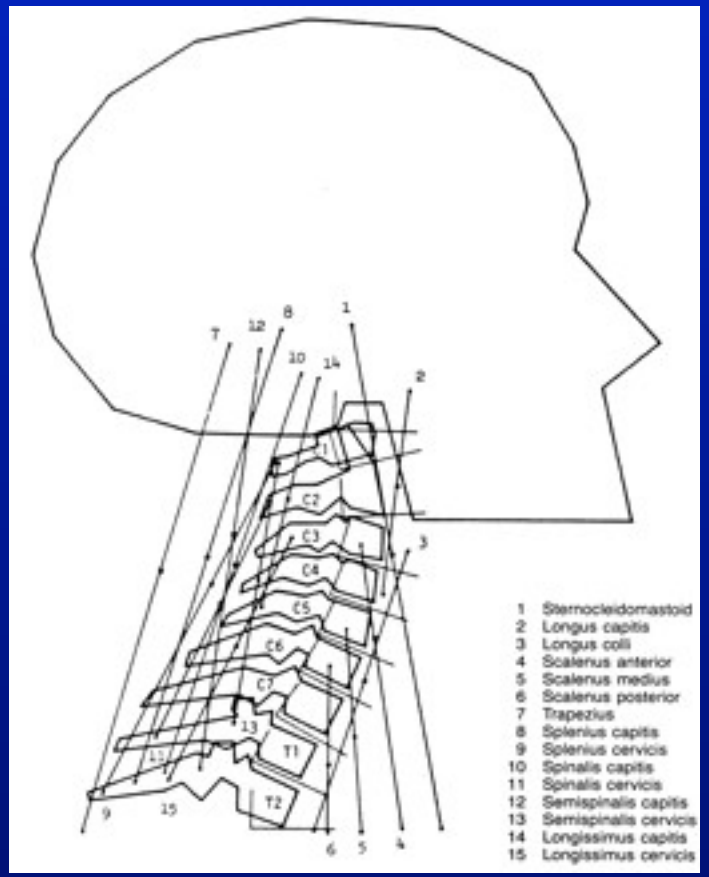


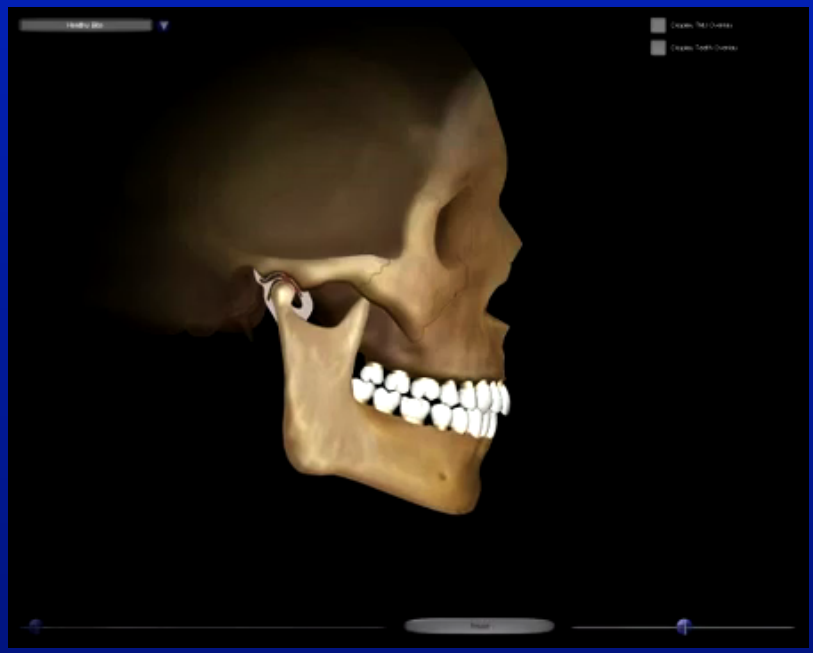
Forward head posture



5.4 kg 14.5 kg 19 kg

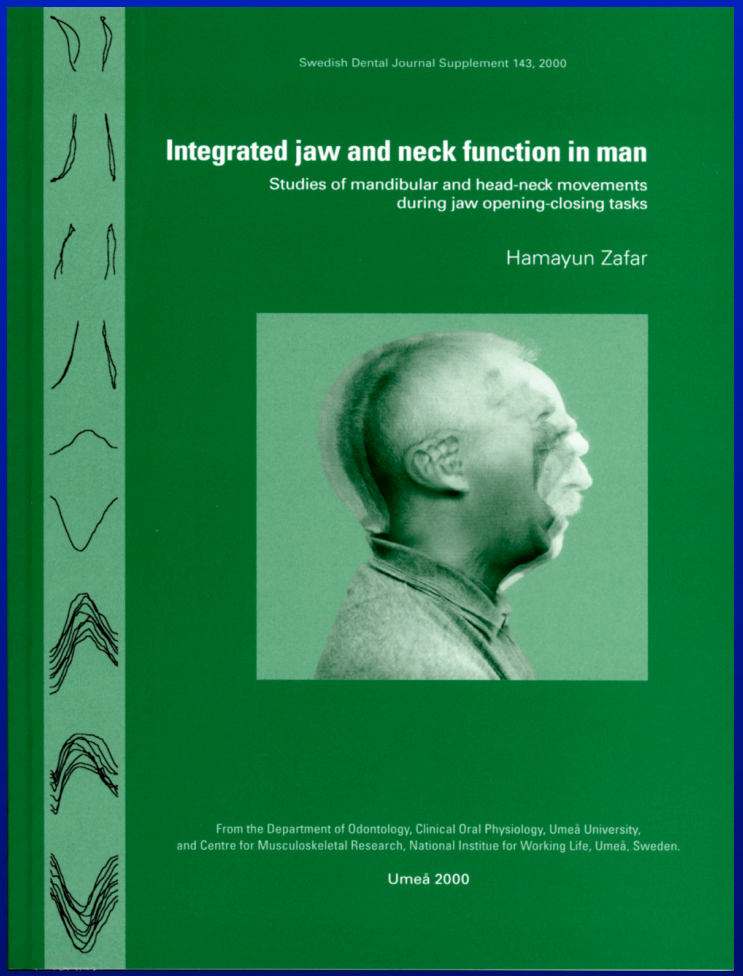
Head-neck and Jaw- no link?





Deng and Goldsmith (1987)
Cited by White and Panjabi (1990)
In "Clinical biomechanics of the spine"

First systematic reaseach on this topic

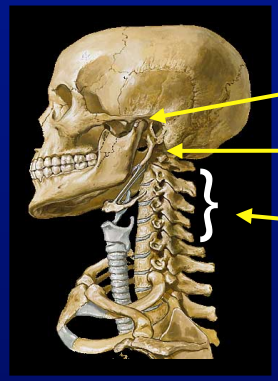


New concept for jaw function

"Functional jaw movements are the results of coordinated activation of

- jaw as well as
- neck muscles,

leading to simultaneous movements in the



- temporomandibular,
- atlanto-occipital and
- cervical spine joints".

Functional jaw movements

Jaw opening is always accompanied by

- head-neck extension

and jaw closing by

- head-neck flexion

Trigemino-neck reflex

Stimulation of trigeminal nerve readily excites neck motoneurons

Trigemino-neck reflex - The earliest reflex

The earliest reflex found in the human embryo (between 7.5 - 8.5 weeks) is the trigemino-neck reflex,

which consists of contraction of neck muscles elicited by light touch of the perioral region.

Integrated jaw and neck function: role in motor control development

Whiplash injury - mechanism

Front impact

Rear impact

Some clinical examples

Effect of restriction of head-neck movements on mandibular amplitude

Unrestrained head-neck

Restrained head-neck

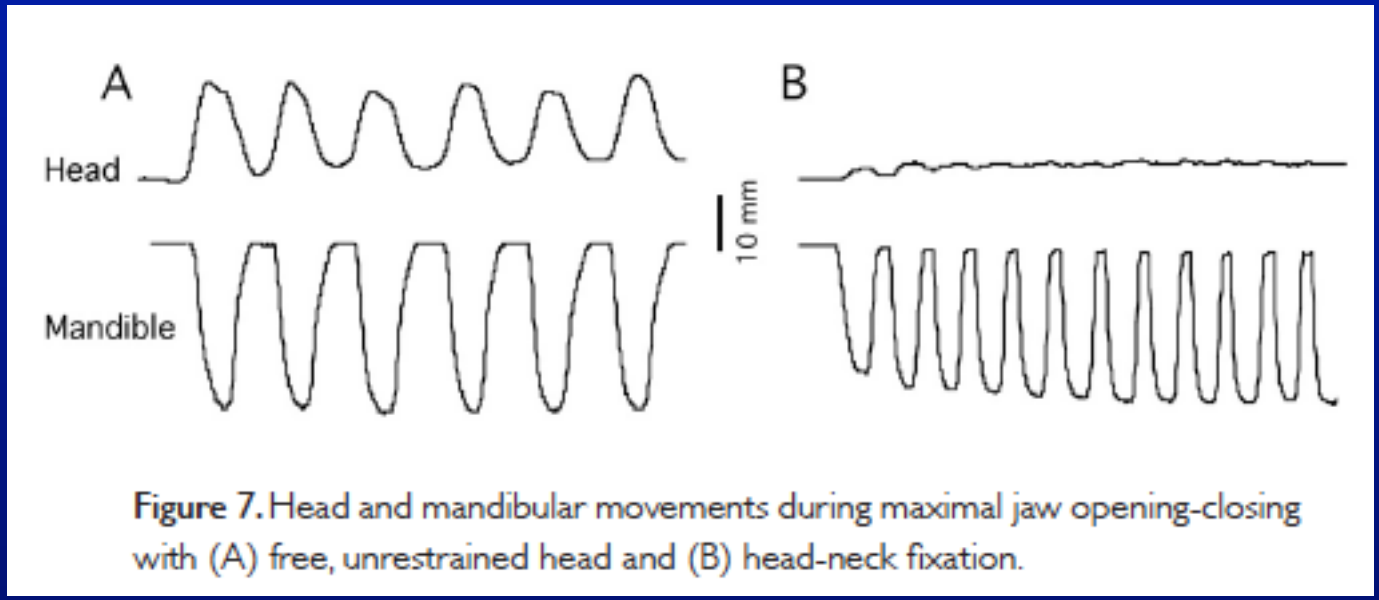


Figure 7. Head and mandibular movements during maximal jaw opening-closing with (A) free, unrestrained head and (B) head-neck fixation.

Cardiovascular and muscle activity during chewingin whiplash-associated disorders (WAD)

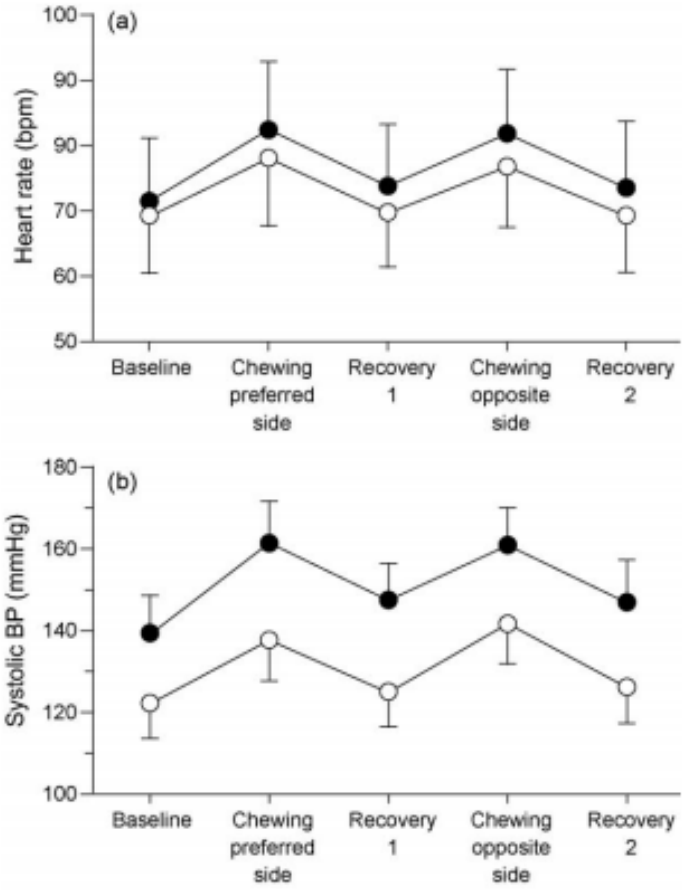
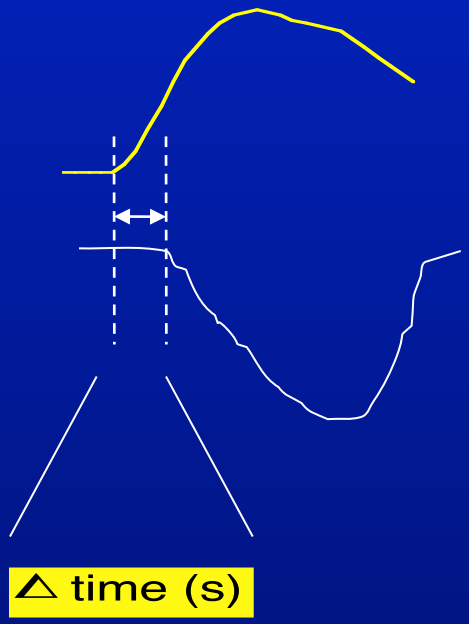
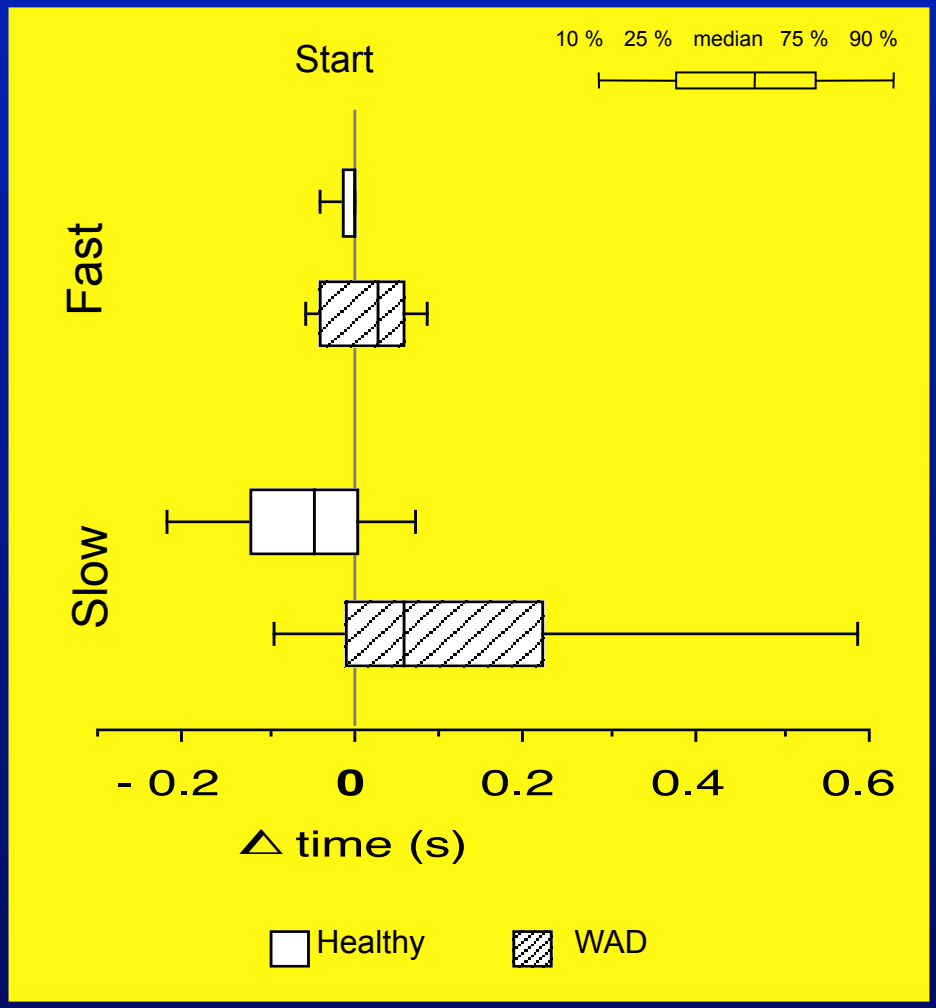


Fig. 3 – (a) Heart rate, and (b) systolic blood pressure during the experiment. Data shown are mean values ± SD. Filled circles represent WAD subjects and open circles represent control subjects.

Kalezic, et.al (2010)

Coordination, “timing” between jaw and head-neck movements





Eriksson, Zafar, Häggman-H (2004)
Eur J Oral Sci

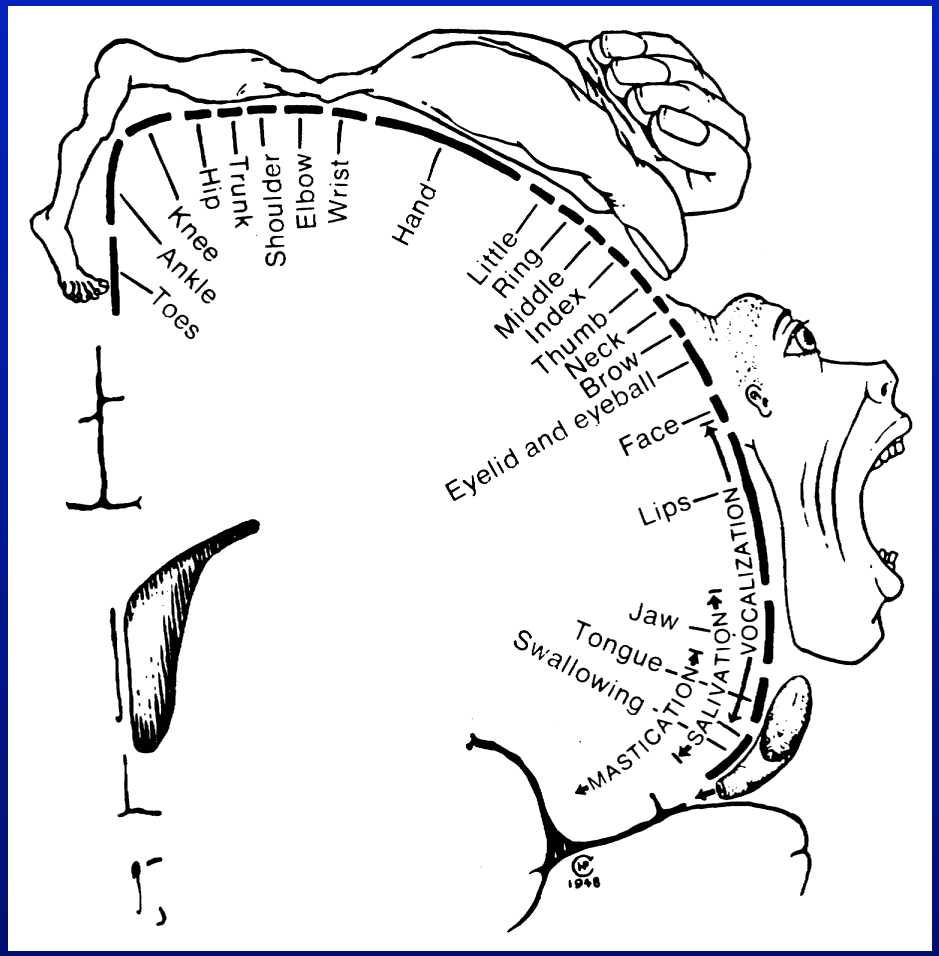
NEURAL PLASTICITY

Short term
Long term

Concept for treatment

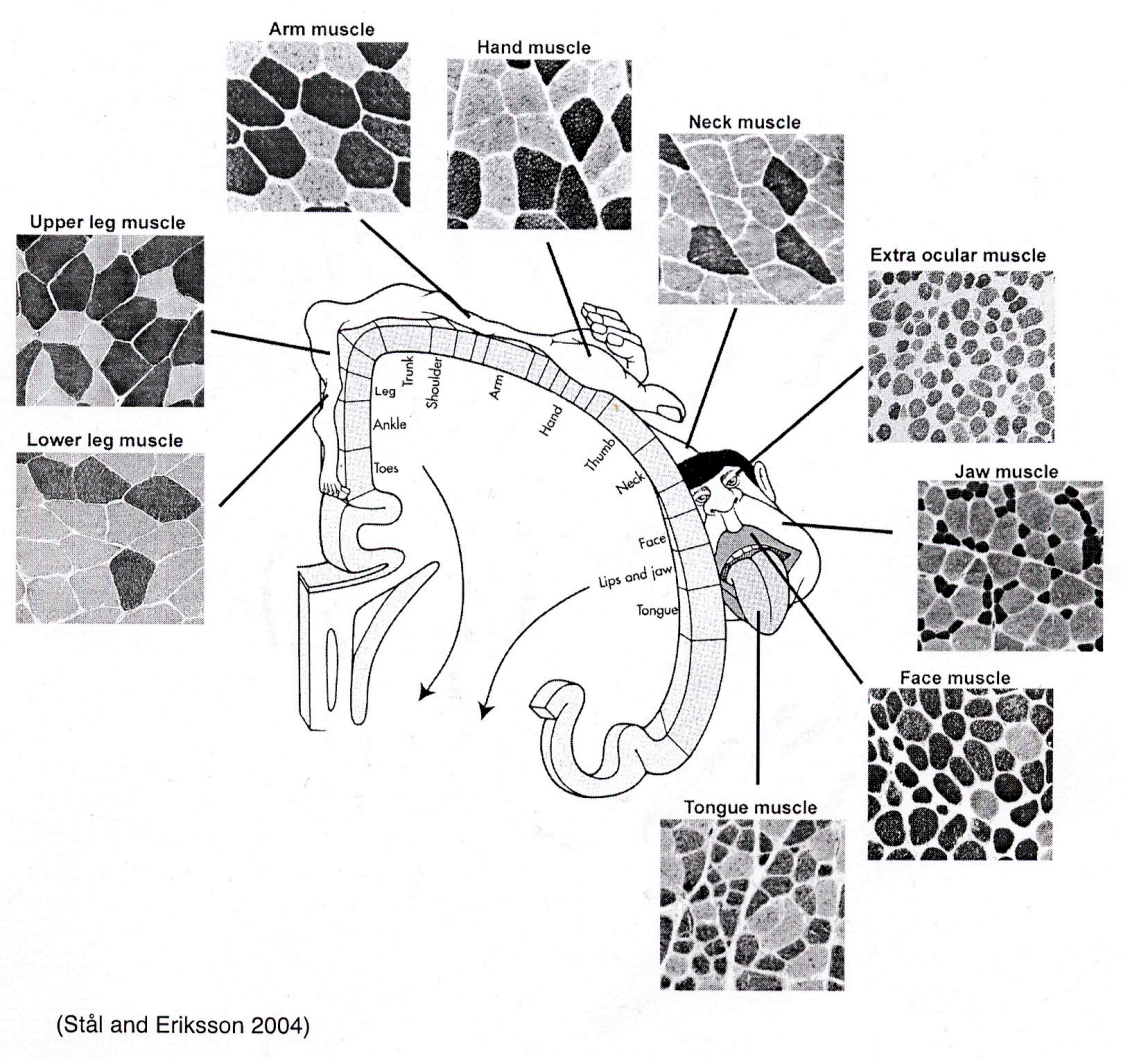
Neuromuscular reprograming

Motor cortical representation



(Penfield and Rasmussen, 1950)

Muscle morphology depends on muscles function

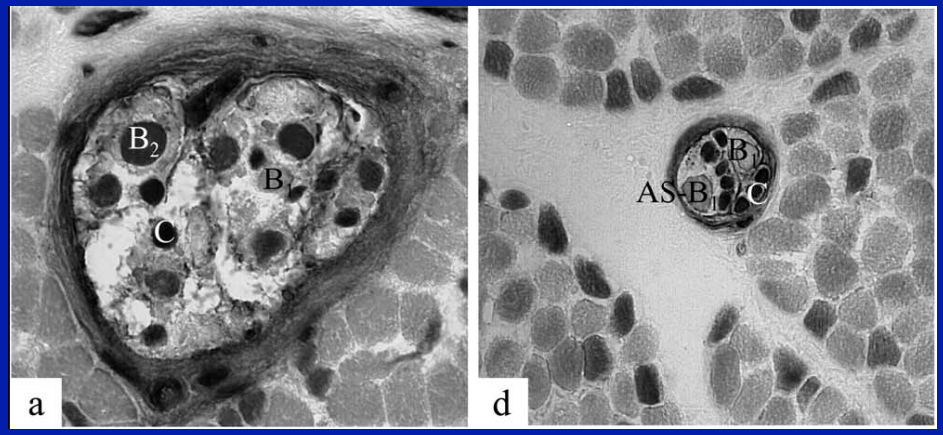


Slow twitch (Type I)

Fast twitch (Type II)

Complexity of muscles spindles in jaw muscles

Masseter Biceps



Cross-sections of muscle spindles

Ostersund et al 2011

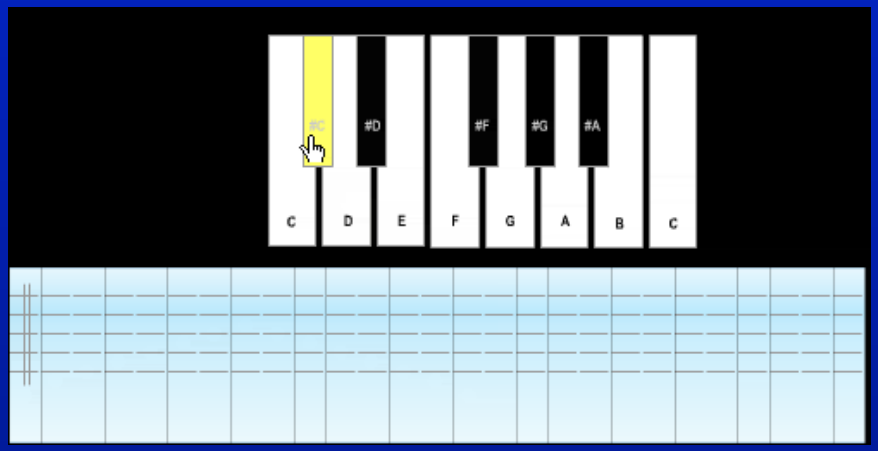
Background knowledge required for reprogramming

“Good” vs “bad” posture and body segment positions

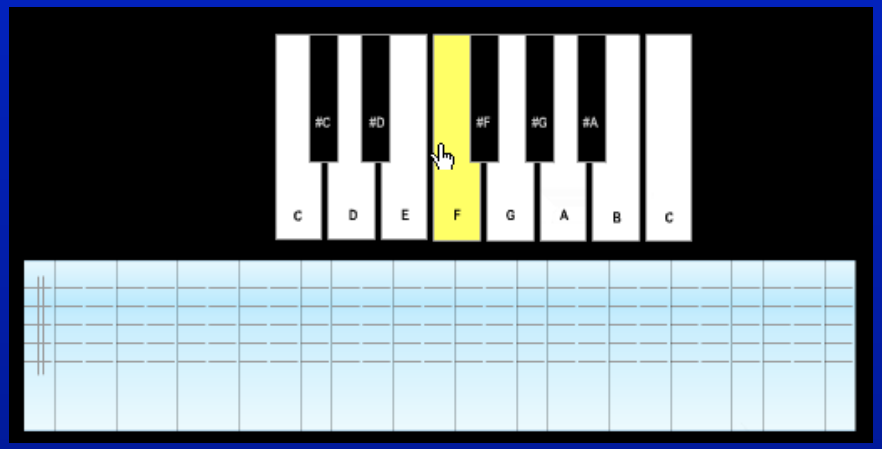
“Good” vs “bad” movement patterns

Knowledge of motor control

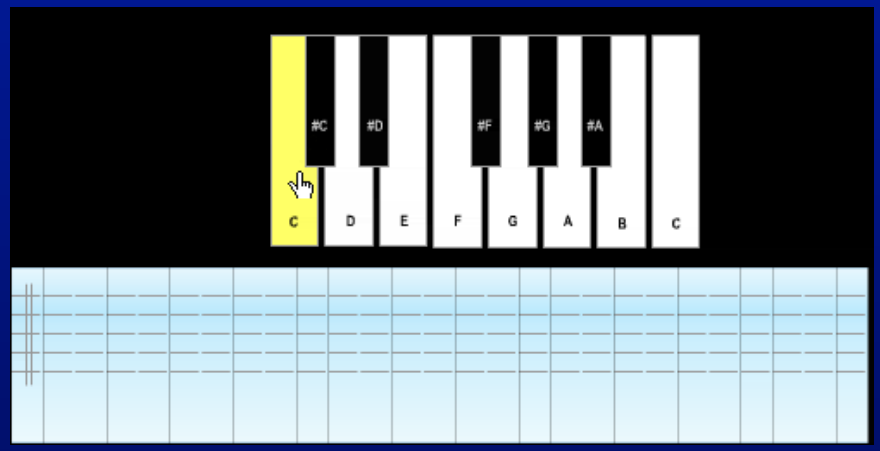
Concept for treatment



“Normal neuronal firing pattern”



“Abormal neuronal firing pattern”



“Re-education of normal neuronal firing pattern”

Carry home message

- Understanding the jaw function is NOT confined for the treatment of jaw pain and/or dysfunction

but has wider role in the

- management and treatment of motor dysfunction of other parts of the body

- Jaw sensory-motor system can effect autonomic nervous system, and thus has wider implications.

A LOT MORE NEEDS TO BE LEARNT !!!!

Thank you!