Deep Tendon Reflex (DTR): History and Mechanism

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History of Reflex

- Reflexes have been studied for centuries and it begins with **Aristotle and Galen**.
- French physiologist, **François Magendie** in Paris and surgeon-anatomist, **Charles Bell** in London were among the first to identify the sensory and motor function of spinal nerve roots
- In the late18th century, **Robert Whytt**, **Johann Unzer** and **Prochaska** set up the reflex concept

- Concept of the ‘reflex arc’ was formulated in the 1830s by **Marshall Hall** (1790–1857).
- **Charles Sherrington** played a central role in understanding the reflex activity from his vast physiologic investigations in the late 1800s to early 1900s

Deep Tendon Reflex

- Deep tendon reflex (DTR) is a key component of the neurological examination
- Lack of knowledge leads to misinterpretation
- Knowledge of important features of reflex responses such as,
  - Amount of hammer force,
  - Strength of contraction,
  - Duration of the contraction and relaxation

- A reflex is an involuntary, unlearned, repeatable response to a specific stimulus that does not require any input from the brain
- Deep tendon reflex (DTR), also known as a myotatic reflex, is a sequence of lengthening, contraction, and relaxation of a group of muscles.
- DTR comprises of a reflex arc, which is a neural pathway that controls a reflex.

- The reflex arc is made up of five components:
  - i) Receptor: muscle spindle
- ii) Afferent fibre: Ia afferent fibres
- iii) Integration centre: lamina IX of the spinal
- cord, synapse on the a-motoneurons
- iv) Efferent fibre
- v) Effector: muscle

- Muscle spindle is a receptor within the muscle that detects changes in the length of the muscle
- Muscle spindle consists of a noncontractile centre portion and intrafusal muscle fibres which make up the contractile portion
- Tapping the tendon will cause stretching of the muscle spindle, activating it, leading to the propagation of an action potential to the spinal cord via afferent Ia fibres through the dorsal horn.

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- In the spinal cord, the afferent nerve fibre synapses with a-motoneurons that supply the agonist muscles and also synapses with an inhibitory neuron that inhibits the antagonistic muscle group.
- This causes a concomitant relaxation of the antagonistic muscle as the agonist muscle groups

- Firing of the afferent fibres (reflecting the sensitivity of the central portion) depends on the length of the intrafusal fibres.
- The intrafusal fibres are controlled by gamma motoneurons, which are influenced by the cortex, cerebellum and various brainstem nuclei.
- This forms the suprasegmental control that modulates reflex activity.
- The higher centres receive information from the muscle spindles.

- For example, the dorsal spinocerebellar tract conveys the information about the proprioceptive organs from the muscle spindle to the cerebellum.
- In return, the higher centres modulate the segmental activity through gamma motoneurons. This, in turn, regulates the quality and amount of information received as the ‘sensitivity’ of the central portion depends on the length of the intrafusal fibres.

THANK YOU

Ooi L-W, Leong LSX, Tee VWS, Chee YC, Halim SA, Ghani ARI, Idris Z, Abdullah JM. Deep tendon reflex: the tools and techniques. What surgical neurology residents should know. *Malays J Med Sci. 2021;**28(2):***48–62. https://doi.org/10.21315/mjms2021.28.2.5