



Ernst Trömner: beyond the reflex hammer

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Abstract

Ernst Trömner (1868–1930) was a German neurologist and psychiatrist at the St. Georg Hospital in Hamburg. As clinician and researcher, he contributed to our understanding of various fields within neurology including language and speech disorders, hypnosis and suggestion, sleep physiology and diseases, leukemia with nervous system involvement, gait disorders, metabolic myelopathy, Parkinson's disease, organic psychosis, and schizophrenia. However, his main interest was muscle reflexes. De facto, Trömner described a variant of the Achilles tendon reflex, a modification of the Oppenheim's and Babinski's reflexes, "rediscovered" the corneomandibular reflex and described the joint reflexes of the lower extremities as well as a muscle stretch reflex of the diaphragm. Moreover, Trömner has developed the first sedimentation chamber to assess the cerebrospinal fluid as well as the muscle plessimeter and, probably most considerable, the reflex hammer which is widely used by neurologists around the globe to date and is commonly referred to as the "Trömner hammer." His name has also become inextricably linked with the finger flexor reflex, which is commonly known as the "Trömner reflex." This article briefly summarizes Professor Ernst Trömner's life and his contributions to clinical neurology and psychiatry beyond his most famous eponyms, the hammer and the finger flexor reflex.

Keywords Ernst Trömner · Reflex hammer · Finger reflex · Calf phenomenon · Diaphragm reflex · Pterygocorneal reflex

Biographical sketch

Ernst Trömner was born on 24 August 1868 in Meerane, a small town in Saxony in the Prussian Empire, in today's Germany. His father was a pharmacist. Trömner suffered from pleurisy and needed to interrupt his time at elementary school. From Easter 1878 to 1881, he attended *school (Realschule II. Ordnung)* in Meerane and, subsequently, the *Friedrichs-Gymnasium* (high school equivalent) in Altenburg, a city in Thuringia, located 17 km north of Meerane. After 7 years in Altenburg, Trömner went to medical school at the University of

Leipzig. After passing the *Physicum* (the first federal board examination in medical school), he studied two semesters in Munich and one semester in Kiel before returning to Saxony. At the Universität of Leipzig, he was student of Ernst Adolf Gustav Gottfried von Strümpell (1853–1925) and Carl Weigert (1845–1904) [1, 2]. Trömner wrote a dissertation on language disorders entitled *Zur Charakteristik der corticalen Sprachstörungen* (On the characteristics of cortical language disorders) and received his doctoral degree (*doctor medicinae*) at the University Leipzig in 1893 [1]. In this year, he was serving as *Volontärarzt* (voluntary clinical physician) at psychiatric hospital in Jena, where he was mentored by Otto Ludwig Biswanger (1852–1929) and Georg Theodor Ziehen (1862–1950). In 1894, he returned to Leipzig to work under the supervision of Wilhelm His (1831–1904) and Wilhelm Maximilian Wundt (1832–1920) [2]. In 1895, Trömner was *Assistenzarzt* (resident) of the psychiatric clinic of the University of Heidelberg under Emil Kraepelin (1856–1926), who was then the director, as well as Franz Nissl (1860–1919) [3]. After a brief spell at the *Stadt-Irre-und Siechenhaus* (psychiatric city hospital and infirmary) in Dresden under Siegbert Maria Josef Ganser (1853–1931), he worked as *Oberarzt* (attending physician) at the neurology department of Charité in Berlin under Friedrich Jolly (1844–1904) [4]. Although having

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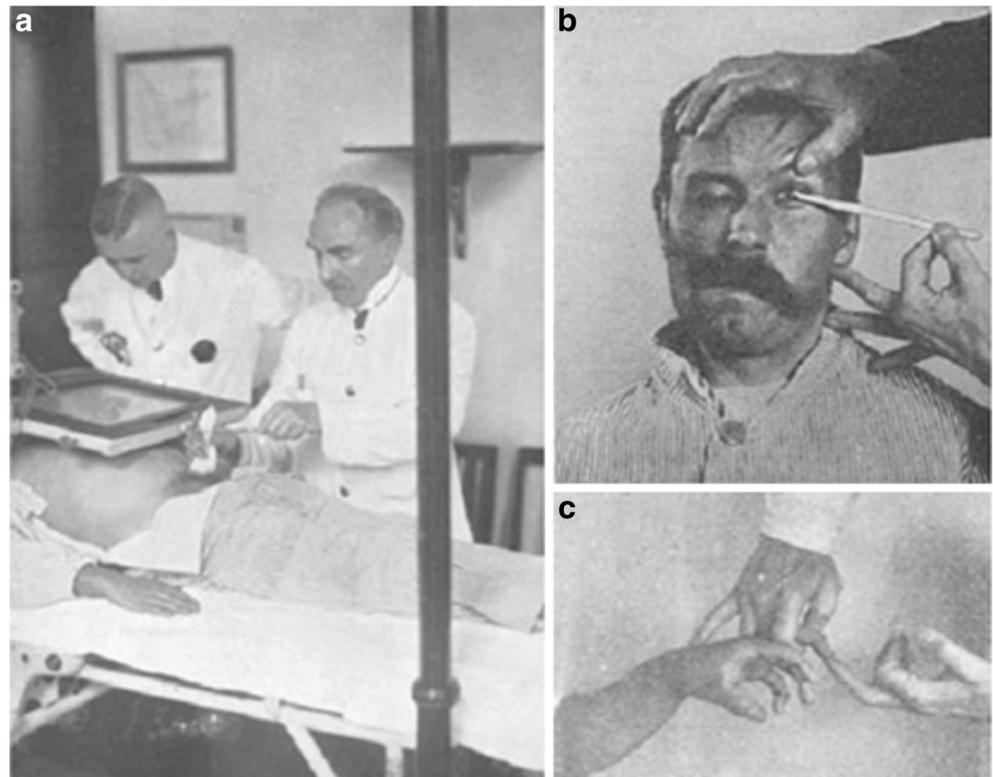
followed a promising scientific career which has led him toward the *Habilitation* (academic degree and prerequisite to a Professorship in Germany) in the near future, financial problems have led him to leave the university track and settle down in October 1898 as a clinical neurologist in Hamburg [2]. Being dissatisfied with the restrictions that are related to working in private practice, he has founded a neurological out patient clinic using his own funds, which he then led for 20 years from 1898 until 1918. During World War I, he was director of the neurology unit of a military hospital. Following Alfred Saenger's (1860–1921) death, he was chosen in 1919 to be a conducting physician of the neurology department at the *Allgemeines Krankenhaus* (General Hospital), located in St. Georg, Hamburg, remaining there for the rest of his life [2]. Trömner became Professor in 1928. While serving as attending physician at the St. Georg-Hamburg General Hospital's neurology department, he received a full professorship in neurology. It is noteworthy that this title was given to him by the governmental health authority, not by any university. At this time, the newly established health care regulations granted every physician at the state hospitals the designation of “managing senior physician and Professor” after 6 years of service as attending physician [5]. On 27 May 1930, Prof. Dr. Ernst Trömner died in Hamburg unexpectedly at 62 years of age after a short malicious illness [2]. In his family, it has been reported that he died of the complications of psittacosis. Trömner was married to Lieseloth Pulvermacher and they had two children, Walter and Helga. His grandson currently lives in Hamburg.

Contributions to neurology

Trömner contributed to neurology, psychiatry, and psychology, publishing numerous scientific papers on various subjects, including language and speech disorders, neuropathology, *Dementia praecox*, gait disorders, organic psychosis, neurosyphilis, Parkinson's disease, metabolic myelopathy, and leukemia with nervous system involvement. However, he concentrated his scientific work above all on hypnosis and suggestion [6], sleep physiology and disturbance [7], and stuttering—which he represented vigorously as a psycho-emotive disorder [8]—as well as the muscle reflexes [9–12]. For 37 years, he was active in neurological investigation and practice, describing—among other things—a variant of the Achilles tendon reflex elicited via the lateral malleolus [13], a modification of Oppenheim's (Hermann Oppenheim, 1857–1919) and Babinski's (Joseph Jules François Félix Babinski, 1857–1932) reflexes [14], he “rediscovered” the corneomandibular reflex [15], and described the joint reflexes (Gelenkreflexe) of the lower extremities [16] and a muscle stretch reflex of the diaphragm [17]. Trömner was also an experienced clinician. As such, he performed examinations with great precision using his own built instruments, *exempli*

gratia, the *Muskelplessimeter* (muscle plessimeter) and the reflex hammer. The muscle plessimeter is a large bent piece of metal or even celluloid spatula in bayonet shape, which is used as a base to elicit muscle reflexes and avoid twitching of the muscle. Furthermore it offers protection against uncomfortable direct blows of the reflex hammer in sensitive patients [18]. There are three prerequisites for reflex examination: the ideal degree of muscle tone required to elicit the reflex must be attained by suitably holding or positioning the respective part of the body, the removal of all reflex-inhibiting attention influences by occupying the patient's thoughts or distracting attention from the innervated area, and a reflex hammer which is sufficiently heavy to inflict short sharp taps to the tendon without causing any pain (Fig. 1). The reflexogenic effect is not elicited by stimulating the tendon, but rather by its sudden percussion. Ernst Trömner designed his hammer reflex model in 1910: “the weight of the entirely metal hammer is approximately 100 g, it is 22 cm in length, lies comfortably in the hand, and it has an 8-cm-wide head, which is encircled by easily replaceable rubber heads at both ends. The larger head is intended for use on the large tendons of the extensor surfaces (patellar, achilles, triceps reflexes) to elicit periosteal and joint reflexes, a process which can be painful if a hammer is used that is too small. The smaller head is used for percussion of flexor tendons (biceps humeri, biceps femoris, and semitendinosus). The smooth handle of the hammer is easy to clean and can be used as a tongue spatula in an emergency. Its pointed end can be used to elicit cutaneous and vascular reflexes. The hammer has been manufactured by B. B. Cassel-Frankfurt, costed 8 Mark including two reserve rubber heads”. Its pointed end is also used to test for the sign of Babinski [20]. Due to its precisely weight-balanced design for control of force for percussion and its excellent capacity of eliciting both myotatic and cutaneous responses, the Trömner hammer has been widely used in Germany since its invention and has also found its way abroad. In 1927, Henry Woltman (1889–1964), an associate professor of neurology at the Mayo Clinic, encountered Trömner's hammer while he was spending 6 months in Europe—including Hamburg, Germany. He was so enthused with this hammer that he purchased five of them. Ever since Woltman brought these hammers back to the USA, the Trömner hammer has come to be identified with Mayo Clinic neurologists [21, 22]. In 1910, Trömner described a new foot reflex, the *Malleolarreflex* (malleolar reflex), a modification of the Achilles reflex. The percussion of the malleoli gives rise to specific reflexes, to be precise, the percussion of malleolus int. (*malleolus medialis*) elicits slight contraction of the *peroneus longus* (*musculus fibularis longus*), whereas percussion of the malleolus ext. (*malleolus lateralis*) activates tibialis posterior (*musculus tibialis posterior*). Both reflexes are without doubt entirely periosteal. In the positive case, this subsequently causes a weak yet very characteristic supination or pronation

Fig. 1 With his muscle plessimeter and reflex hammer, Prof. Dr. Ernst Trömner (right) demonstrates the *Zwerfellreflex* (A) [17], the *Pterygo-Cornealreflex* (B) [19], and the *Fingerphänomen* (C) [12]



movement of the foot. In neurological patients with absent Babinski's and Oppenheim's signs, Trömner found his *Malleolarreflex* in 50% of cases [13]. The credit for the *phénomène des orteils* (toe phenomenon) should go to Ernst Julius Remark (1849–1911), who described it in 1893, as well as Babinski for his systematic investigating of this phenomenon. Since then, many modifications have been made to evoke the plantar reflex. In 1911, Trömner described the *Wadenphänomen* (calf phenomenon), a modification of Babinski's and Oppenheim's reflexes [14]. By supporting the semi-flexed and laterally rotated leg of the patient against one's hand, and grasping the back of the knee from the inside with the other hand, then making a strong stroking movement towards the foot—as if performing a centrifugal massage on the gastrocnemius muscle—the effect of *tibialis anterior* (*musculus tibialis anterior*) and *extensor digitorum communis* causes a dorsal reflex of the foot to be elicited. If the stimulus is strong enough, a full withdrawal reflex can be elicited, such as with Babinski's and Oppenheim's signs. Of course, it is merely a modified version of the withdrawal reflex, albeit a particularly sensitive one and can still be elicited when Babinski's and Oppenheim's signs are not to be found" [14]. The *Fingerbeugephänomen* or *Fingerphänomen* (finger flexion reflex)—which still bears Trömner's name ("Trömner's reflex")—was first presented on January 2nd, 1912 during a meeting of the Hamburg Medical Society [23]. Trömner's reflex is similar to the *Knipsreflex*, which in Anglo-American literature means Hoffmann's sign, although

Johann Hoffmann (1857–1919) never it described, but rather his student Hans Curschmann (1875–1950) [24]. Trömner's reflex was described as: "a pathognomonic finger reflex ... reflex of the arm, analogous to the Babinski, which is as pathognomonic for conduction abnormalities above the spinal centers innervating the arm as the Babinski's phenomenon for the leg" [23]. Thus far, such a phenomenon was "missing" when he presented a 29-year-old woman with spastic spinal paralysis secondary to syphilis. As one reads, Trömner initially thought that he had discovered the Babinski's sign of the arm, and he continued to report this interpretation in another article published in 1913, although he was more cautious in a publication of 1923. In this report, Trömner stated that if there was a response of only minor flexion of the fingers, the possibility of "a neuropathic condition" could be considered, although stronger reactions indicate a "pyramidal lesion" [25]. Trömner compared his *Fingerphänomen* analogously to the Rossolimo (Grigori Ivanovich Rossolimo, 1860–1928) toe reflex, and if there is a significant flexion of all the fingers including the thumb, an organic disease above the center of the flexors is assumed. In fact, the finger flexor reflex of Trömner must thus be regarded as a normal reflex and analogous to Hoffmann's, Rossolimo's, and Wartenberg's (Robert Wartenberg, 1886–1956) signs. Accordingly, the *Fingerphänomen* is in itself not a "pyramidal sign". It may only be considered pathologic when it is highly exaggerated or if the response is unilateral [24]. Therefore, the finger flexion reflex is not the "Babinski of the upper extremities",

it may be more accurately be considered an “Achilles tendon reflex of the upper extremities” [26]. Trömner’s reflex is commonly used as a clinical neurological examination for upper motor neuron lesions (“pyramidal syndrome”) above the fifth or sixth cervical segments of the spinal cord. Moreover, it is a highly sensitive test in clinical neurological examination. The electrophysiological assessment of this reflex can also serve as an objective marker for cervical spondylotic myelopathy [27]. In 1918, Trömner described “a new bulbar reflex”, the *Pterygo-Cornealreflex*, i.e., when the cornea is touched lightly with a small glass rod, the lower jaw is pushed to the opposite side. This response is a reflex from the sensory to the motor trigeminus that innervates the lateral pterygoid muscle [15]. Friedrich Leopold von Sölder zu Prakenstein (1867–1943) defended the priority of his discovery of 16 years before [28]. The reflex—which von Sölder called the *Corneo-mandibularreflex*—is elicited by touching the cornea. It is a brief prominent deviation of the lower jaw away from the side on which the cornea is stimulated. The area of stimulation is strictly limited to the cornea, which is also the region of stimulation for the corneal reflex; therefore, under normal conditions, this reflex always occurs at the same time as the corneo-mandibular reflex. Von Sölder described that the *Corneo-mandibularreflex* was a physiological reflex, although it occurs under certain pathological conditions, particularly in coma of diverse origins [19, 28]. On the other hand, Trömner held the opinion that the *Pterygo-Cornealreflex* was only observed in patients with suprabulbar lesions of the brain. In the opinion of Wartenberg, the pterygocorneal reflex presents one of the finest signs of damage to the cortical center for the mandible or the efferent tract arising from this center [29]. In 1923, Trömner developed the *Sedimentator*, a first sedimentation chamber to assess the cerebrospinal fluid. The great advantages of the chamber—a primitive form of which Trömner had incidentally already tested in 1916—became apparent during its first trials. In a number of cases of tuberculous meningitis, for which the existing procedure had only produced small amounts of cellular deposits and no bacilli, his *Sedimentator* produced significantly richer cellular deposits, the cells exhibited less damage and the tubercle bacilli could be readily dyed. A further advantage is that the sedimentation chamber also only allows quantitative cell classification to be taken into account [30]. Some of the joint reflexes of the upper extremities are the Mayer’s *Grundgelenkreflex* (basal joint reflex) (Carl Mayer, 1862–1936) and the Léri’s *signe de l’avant-bras* (forearm sign) (André Léri, 1875–1930). The lower extremities also display a *Grundgelenkreflex*. De facto, Trömner described the (*Gelenk-*)*Reflexe* of the lower extremities [16]. He observed that every time he swiftly and strongly flexed or stretched a leg of a patient with lesion in the lateral corticospinal tract, there would be an extension of the hallux, sometimes involving “flexion of the foot”—which of course referred to “dorsal flexion”. This was more clearly visible

when extending than flexing the extremity. The effect could not be observed in all, but in about half of all patients with spasticity, i.e., in apoplectic paralysis, *lues spinalis*, and particularly often in multiple sclerosis, the bottomless treasure trove of rare reflexes. The result of these joint reflexes is the same as in the skin reflexes: extension of the hallux, dorsal flexion of the foot as in Babinski, Oppenheim, etc. Since it only occurs in spastic conditions, they are always pathognostical and can be considered “pyramidal signs.” Nevertheless, they will hardly acquire any essential diagnostic relevance, since they do not occur initially, but only after the development of clear spastic symptoms, which makes them inferior to the initial symptoms of Babinski, Oppenheim, and Trömner (calf phenomenon) [16]. Physiologically, it is permissible to assume that every striated muscle contracts and nearly all muscles can be clinically stimulated by swift stretching. Hypothetically, it would also be possible to excite muscles located inside the body, such as the diaphragm. In 1928, Trömner demonstrated a diaphragm reflex, the *Zwerchfellreflex* [17]. In a patient with neurosyphilis and increased skeletal muscle reflexes, Trömner examined the excitability of the abdominal muscles using a reflex hammer and muscle plessimeter on the *Os pubis*, whereby no recovery of the abdominal wall occurred in response. However, he observed a significant twitch of both diaphragmatic cupula. He suspected that the theoretically diaphragmatic reflex could be captured by X-ray imaging and the pneumograph curve. Trömner enumerated the clinical diagnoses in eight patients in whom he documented the *Zwerchfellreflex* [17]. Trömner, by the way, was not correct in stating that the abdominal muscle reflexes were unknown until he introduced the method of their elicitation by crosspercussion of the muscles. Prof. Dr. Med. Ernst Trömner, perhaps more than anyone else, has contributed to the classification of the reflexes and to a clear distinction between abdominal muscle and abdominal skin reflexes previously, but his work, written in brief, apodictic style, remained almost completely unnoticed [24].

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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