Lumbricals and the lightness of touch – a basic surgical skill

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Abstract

This is an anatomical explanation how to achieve and practice lightness of touch with forceps

Key Words

Lumbricals, pulp of finger, Meissner corpuscles, Merkel cells, basic surgical skills

'Infinite gentleness, scrupulous care, light handling and purposeful, effective, quiet movements which are no more than a caress, are all necessary if an operation is to be the work of an artist and not merely of a hewer of flesh'

Lord Berkeley Moynihan

Lord Berkley Moynihan eloquently describes the attributes of dissection. These principles are tacit to the expert surgeon. They have traditionally been acquired over time and learnt by volume. The past president of the RCSEng legitimately said it was no longer appropriate to practice on patients. Today, the volume of operating that a trainee is exposed to has significantly reduced [1.] The trainee is therefore encouraged to attain these skills through simulation and practice in 'bootcamps'[2]. Seldom, however, do these courses teach the aspiring surgeon lightness of touch.

We surgeons are privileged in having a profession which also encompasses a craft; by it we should have understanding of the problems of craftsmanship in modern life. Ultimately it is at the core of human happiness. Craftsmanship is based upon creative ability, good design, the almost loving conflict of man and material, and the consequent unification of both in completion.

Norman Capener

Our craft is delivered through our hands. Norman Capener eloquently described the hand and how to hold instruments in of surgery[3]. His descriptions were beautifully illustrated by the famous British artist, Hepworth. Surgical instruments are ergonomically designed to deliver a specific function. This can only be attained by using the instrument correctly and employing the correct muscles. The intrinsic muscles of the hand alone can move an instrument with a lightness of touch. The correctness and handling of instruments, the sword, was well described by the Samurai[4]. Rhythms are found in everything and in martial arts, like surgery, it cannot be achieved without practice or attention to correctness.

Professional instructors and teachers in many sports disciplines that use a racket, club, bat or sword emphasise the position of the hands and the lightness of the grip; too firm a grip curtails the ability to affect the proper movement and impairs the function of the club or sword. This, on first thinking, is counter intuitive to the beginner who is more focussed on the swing and generating power rather than letting the golf club or sword do the work i.e. effect the action for which the club or sword is uniquely and functionally designed. The professional coach, on the driving range or in the 'dojo' always attends to the basics of grip and posture before proceeding to explain how to generate more

distance or power. This reinforced at every lesson; the martial arts 'Sensei' attends to the basic principles of posture and techniques at every 'Kyu' and even beyond Black Belt – correctness is reinforced and with practice comes rhythm. Indeed, at higher grades there is an expectation that the basics are demonstrated in every 'kata' all the time – some examiners make this a pass or fail criterion. Power and speed come with practice and time. The initial 'awkwardness' of some of the positions start to make sense and facilitate the flow of the complex movements. The practice and art of surgery is much the same. The discipline involves the use of many tools that have been designed and eponymously named after surgeons who have understood the ergonomics and nuances of operating[5]. We trainers, however, are often remiss in not explaining these fundamentals that apply to all basic surgical skills.

The use of forceps in the non-dominant hand is ubiquitous in surgery. The forceps are used to retract and stabilise tissue and occasionally needles to enable the dominant hand to stitch or dissect. The operating surgeon frequently has an assistant who likewise is expected to hold forceps to facilitate the operation with exposure and retraction of tissues. Very few trainers however take time to explain how to hold use forceps. Basic Surgical Skills courses do point out the difference in toothed forceps (Adson) that can puncture tissue and non-toothed forceps (Debakey) that can crush tissues. The function and usages of each of the forceps are different but that handling and application of a lightness of touch is sometime reinforced. But, how to achieve that lightness of touch is not explained.

The optimum handling of the forceps can be best understood by understanding the applied functional anatomy of the upper limb and the hand.

Sometime trainees hold forceps like a 'salad server' – the instrument is held in the palm of the hand the opening and closing is affected by using flexor policis longus with the instrument resting on the middle or distal phalanges of the index finger. Flexion and extension of the elbow adjusts the height and pronation and supination of the forearm is used to 'burger flip' and rotate ***figure 1.***

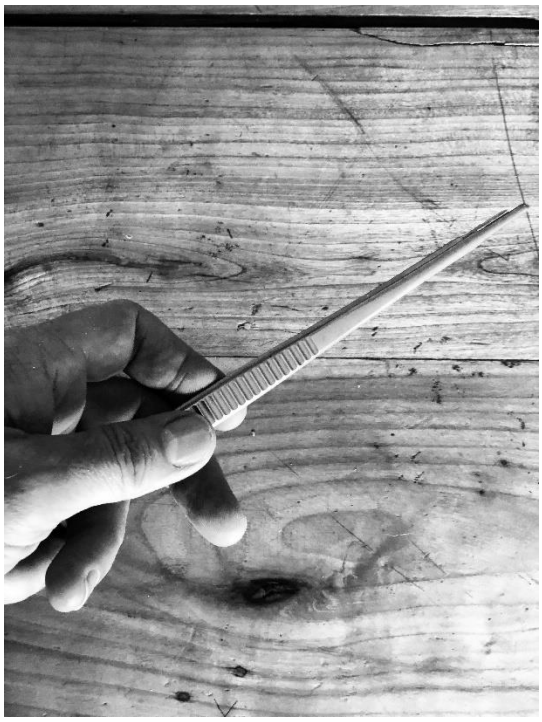

Figure 1: The forceps held as a 'salad server@

The second ‘aberrant ‘way trainees hold forceps is like a ‘brush’. Here the forceps are held between the pulp of the thumb and the middle DIP joint. The forceps are not stable as the ‘foundation’ or ‘base’ is made up of only two points and not three. Although many may feel this is an effective way to hold tissues at depth, the forceps at risk of ‘yawing’ with moving the hand or forearm ***figure 2***.

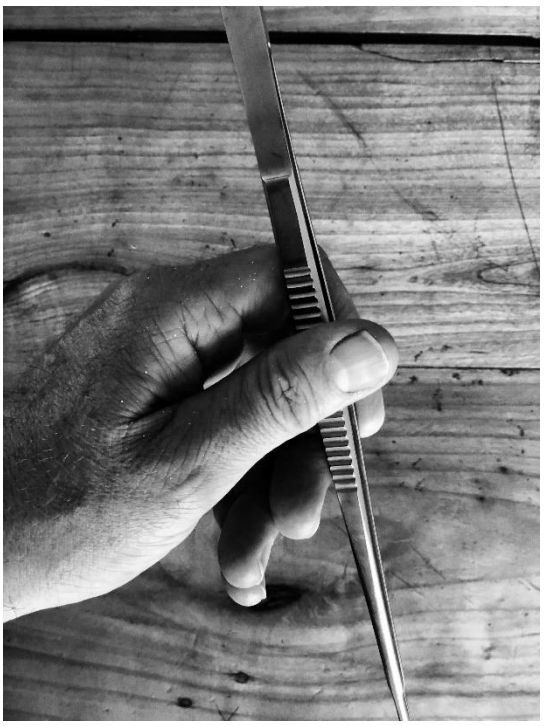

Figure 2: The forceps held like a ‘brush’

Commonly, trainees often hold forceps like a ‘pen’ ***figure 3*** – this involves the flexion of the distal interphalangeal (DIP) joints effected by all the long flexor and extensor muscles of the forearm. Movement is occurring with flexion and extension of the wrist and turning with pronation and supination of the forearm. Although the forceps are stable, i.e. lying on the first dorsal interosseous muscle and the phalanx of the middle finger, only the tips of the index finger and the thumb are applied to the instrument because of the flexion of the DIP joints. The tips of the fingers are pressed against the instrument and blanching of the nail beds can be noted. A great deal of pressure is generated applied particularly by flexor digitorum profundus (FDP) and flexor policis longus (FPL). Both have large muscle bellies that are found in the forearm with tendons that extend into the hand. FDP originates at a large part of the proximal and anterior surface of the ulna and the interosseous membrane and inserts at the bases of the distal phalanges of the fingers. It flexes the distal interphalangeal joints and helps flex the wrist. FPL arises from the anterior surface of the radius and surrounding interosseous membrane and attaches to the base of the distal phalanx of the thumb. Together they form the deep muscles of the forearm. The action of writing requires a good grip on the pen as the fingers are flexed and extended with concomitant movement of the wrist and upper limb as the letters are formed across a page.

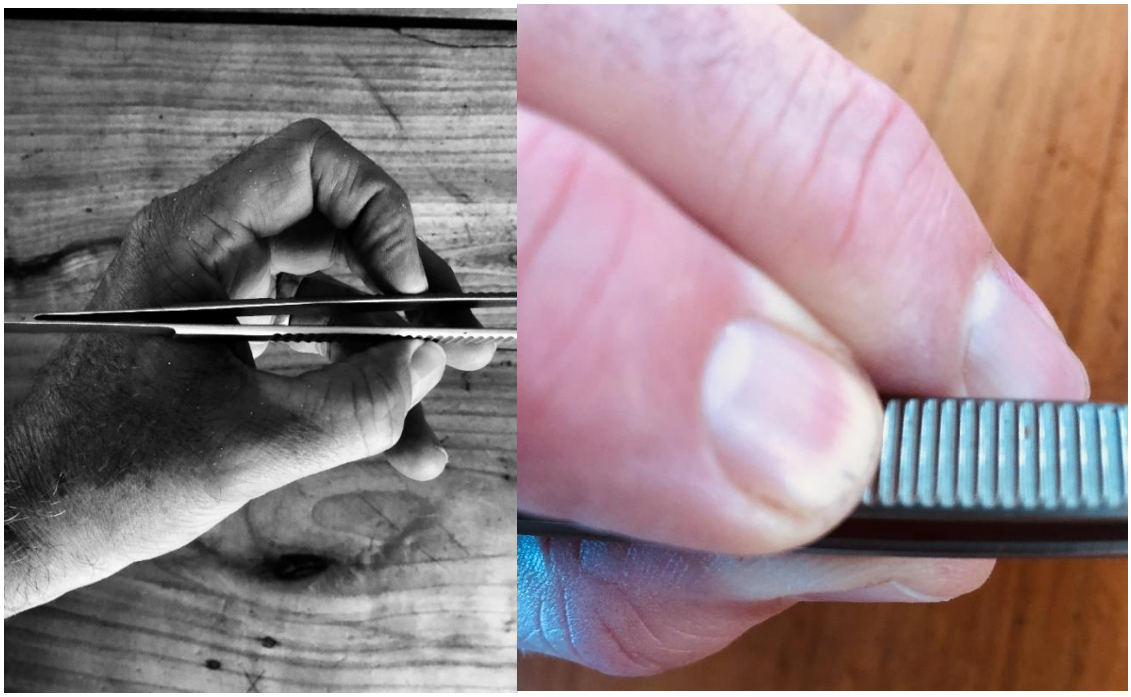

Figure 3: The forceps held like a pen – the long flexors of the forearm (flexor digitorum profundus and flexor polocis longus) flex the DIP joints and apply excessive pressure to the instrument as evidenced by the blanching of the nail bed

Lightness of touch can be achieved by using the intrinsic muscles of the hand. The lumbricals (lumbricidae - Latin = earthworm) are four short muscles located in the metacarpal region of the hand and lie deep to the palmar fascia. They are unique muscles as they do not have any bony origin or insertion. There are four in each hand – two are supplied by the median nerve and two by the ulna nerve. They arise from the tendons of flexor digitorum profundus in the palm and pass along the lateral side of metacarpophalangeal joints to insert into extensor expansion on the dorsum of proximal phalanx. Their function is to flex the metacarpal phalangeal joint and extend the proximal and distal DIP joints. The resulting position of the fingers is not too dissimilar to the position required to hold a glove puppet – a 'Kermit the frog' position or 'intrinsic plus position' ***figure 4***.

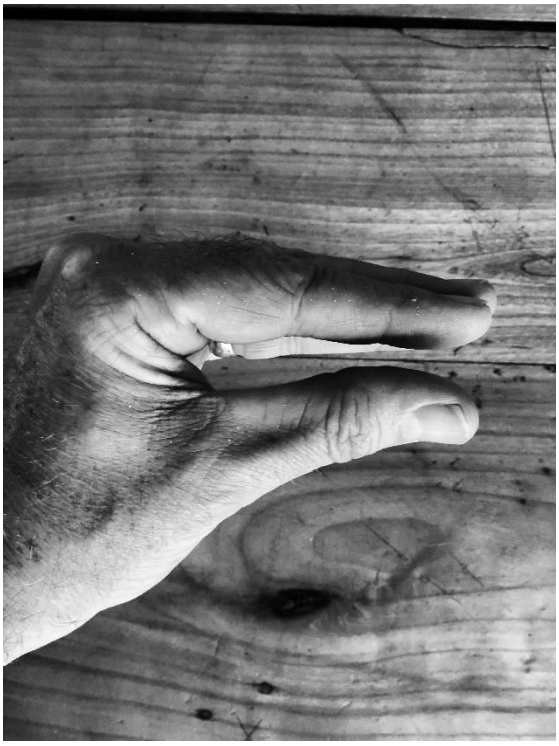

Figure 4: The use of the intrinsic muscle of the hand – the lumbicals flex the metacarpal phalangeal joints and extend at the proximal and the distal DIP joints. The opponens policis of the thenar eminence closes the thumb on the instrument – the Kermit the frog glove puppet position

The forceps can then be cradled on the first dorsal interosseous muscle and the distal phalanx of the middle finger. The index finger and thumb are then closed by the action of the lumbricals on the index finger and the opponens policis of the thumb ***figure 5***. This is one of the three thenar muscles of the thumb. It arises from the flexor retinaculum of the hand and the tubercle of the trapezium and passes downward and laterally to insert into the whole length of the metacarpal bone of the thumb on its radial side. Closing of the index finger and the thumb around the forceps does not invoke the action of the forearm muscles. Moreover, the pulp of the index finger and the thumb are maximally applied to the instrument and there is no blanching of the nail beds. A lightness of touch is automatically applied. Pronation and supination of the forearm and circumduction of the shoulder are only required to put the hand into the right position. The hand can be rested on a surface or supported by the extension of the fifth digit to achieve stability. These principles can be applied to all handheld instruments. Surgeons who practice fine skills e.g. plastic, ophthalmic, ENT, neuro or cardiac surgeons, consciously or unconsciously adopt this grip and posture. The movement of the instruments in the operative field is achieved through intrinsic muscles of the hand alone and obviates the need to use any of the more powerful muscles of the forearm and removes the likelihood of tremor or exaggerated movement.

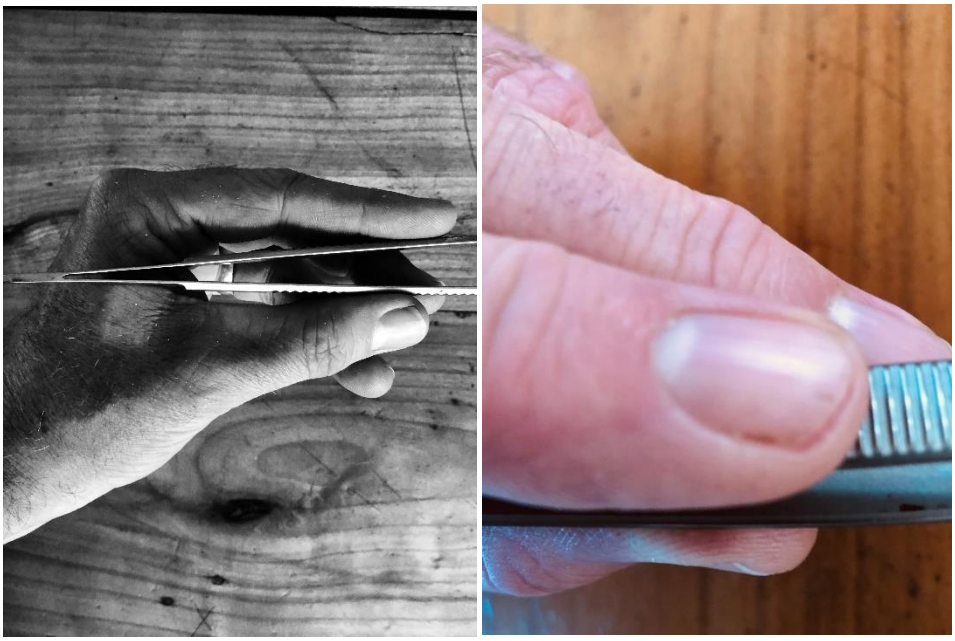

Figure 5: The forceps is cradled in the hand and the pulp of the finger and thumb is brought into contact with lightness of touch as evidenced by the absence of nail bed blanching

Furthermore, it maximises the contact surface area of the pulp of the fingers. This can be demonstrated by picking up forceps that is covered in white emulsion paint ***figure 6.***

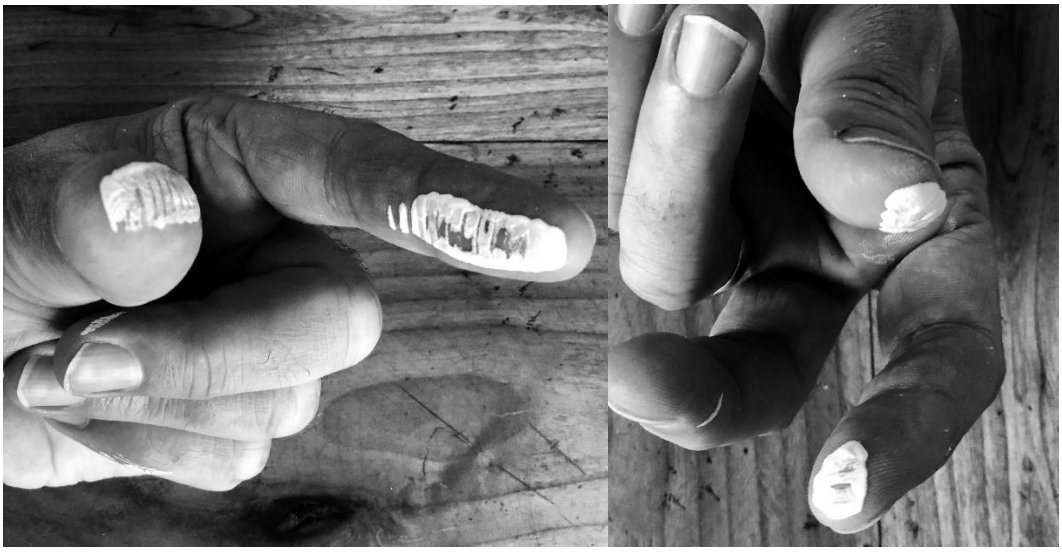

Figure 6: The contact area of the pulp of the fingers is maximised with the 'Kermit grip' as opposed to the 'pen grip'

Maximising the area of the pulp of the finger in contact with instrument greatly enhances the efficacy of the two mechanoreceptors in the skin that are enriched in the pulp of the fingers. The boundary between the dermis and epidermis is not regular and is thrown into folds or dermal papillae. The Meissner corpuscles are found at the apex of these folds. They consist of layers of flattened cells with elongated nuclei and surrounded by a coiled neuron that is stimulated to register touch when the corpuscle is deformed. The second touch receptors are the Merkel cells. They are found in the basal part of the epidermis and closely associated with the unmyelinated tip of the

nerve. The cells themselves are unencapsulated and have a small receptive field to pinpoint the lightest of touches.

This understanding and appreciation of the use of surgical instruments is tacit to the expert surgeon. Surgical trainers, like professional golf coaches, should be able to address how trainees hold instruments and explain 'why' they held in a particular manner. Knowledge of the functional anatomy of the hand and upper limb together with the fact that myriads mechanoreceptors in our fingertips will result in an appreciation of how to achieve the lightness of touch described by Lord Berkeley Moynihan. These basics are often forgotten in the busy operating theatre and seldom taught in the skills laboratory[6]. It is however the focus of our new basic skills course - the Black Belt Academy of Surgical Skills. www.BBASS.org .

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