



**THE HUMAN TRAPEZIO-METACARPAL JOINT**

**— an anatomical, osteometric and clinical study**

**A THESIS SUBMITTED FOR THE DEGREE OF MASTER OF SCIENCE**

by

**PATRICIA HELEN TROTT**

**DIP. PHYSIO., A.U.A., GRAD. DIP. ADVANCED MANIP. THERAPY**

**Department of Anatomy and Histology  
The University of Adelaide  
Adelaide  
South Australia**

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## SUMMARY

A study of the function of the human trapezio-metacarpal (T-M1) joint has been undertaken. This investigatory work comprised three separate components – anatomical, osteometric and clinical.

The *ANATOMICAL STUDY* of 28 unembalmed specimens within 24 hours of death demonstrated different attachments of the first inter-metacarpal ligament from those previously described.

The range of five passive movements, comprising circumduction, were measured radiologically, wide variation being found between individuals.

Ligamentous function was described in terms of the control of angular movement and axial rotation of the first metacarpal. While all four ligaments contributed to the control of each individual movement, the major limiting functions of each ligament were delineated.

Staining of the articular cartilage revealed fibrillation as early as the second decade of life. A consistent pattern of degeneration was noted, peripheral fibrillation being more marked on the antero-lateral, lateral and medial aspects of the trapezial surface and on the posterior aspect of the metacarpal.

The *OSTEOMETRIC STUDY* was carried out on the articular surfaces, cartilage in situ, of 23 T-M1 joints. A three-dimensional grid reference method of measurement of the articular surfaces was developed. Data thus obtained was used to measure, for the first time, the following geometrical features of the articular surfaces: the mean angle between the two axes on the trapezium and first metacarpal, the arc length of the two axes and the surface area of the cartilage.

The detailed *CLINICAL STUDY* of 492 T-M1 joints (using a questionnaire, radiological and clinical procedures), investigated the relationship of specific demographic variables, generalised peripheral joint hypermobility, occupational use and osteo-arthritis to the mobility and stability of the T-M1 joint. Comparisons were made with a sample of 'medically normal' joints (N=174).

T-M1 joint mobility was found to decrease significantly with advancing age ( $p < .005$ ) and with cumulative use of the thumb ( $p < .005$ ). The incidence (%) of osteo-arthritis was significantly related to a past history of pain at the thumb base ( $p < .00001$ ), peri-articular thickening ( $p < .00001$ ), ageing ( $p < .0001$ ) and cumulative use of the thumb ( $p < .005$ ).

The T-M1 joints of 33 individuals exhibiting generalised peripheral joint hypermobility showed a significantly higher incidence of dorso-lateral instability ( $p < .0005$ ) when compared with the non-clinical group. Differences in mobility between the two groups were greatest for the accessory movements.

Consistently different usage of the thumb formed the basis of the three occupational groups studied – manipulative therapists (40 thumbs), tailors and dressmakers (72 thumbs) and players of the violin, viola and 'cello (70 thumbs). Occupational use resulted in loss of mobility in movements not regularly exercised and a higher incidence of osteo-arthritis associated with long periods of isometric holding with the thumbs.

The incidence (%) of stiff and abnormal quality scores rose with advancing osteo-arthritis, being a more consistent finding in the accessory movements (osteo-arthritis group, N=198 thumbs). The earliest radiological sign of osteo-arthritis was seen on the dorso-lateral aspect of the trapezial surface. As T-M1 joint osteo-arthritis became more marked, so did the incidence of involvement of the other trapezial articulations. A regular menstrual cycle was found to be a significant factor in lowering the incidence of osteo-arthritis of the T-M1 joint ( $p < .01$ ).

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**DECLARATION**

I declare that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any University; and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

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## LIST OF DEFINITIONS

**Active Movements** are those movements which can be performed voluntarily.

**Passive Movements** are those movements which are produced by an outside force.

**Physiological Movements** are movements which can be produced voluntarily. When these movements are carried out passively they are classed as **PASSIVE PHYSIOLOGICAL MOVEMENTS**.

**Accessory Movements** are movements which cannot be performed actively in the absence of resistance (Warwick and Williams, 1973). They can, however be produced passively.

**Dorso-lateral instability )** In this study these terms are used synonymously.  
**Dorso-radial instability )**

**Osteo-arthritis** – an active inflammatory disease in joints with radiological evidence of osteo-arthritis.

**Osteo-arthritis** – radiological evidence of degenerative changes in a joint (classification of these changes is given in Table 4.2).