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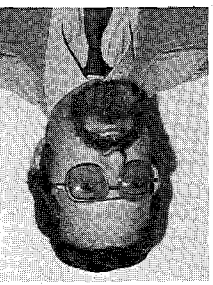
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# Thermography as a Diagnostic Aid in Tennis Elbow

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\*\* From the Orthopaedic Department, Sheba Medical Center, Tel-Hashomer



Ruth Shilo M. D. Born July 1930 in Leipzig, Germany. Primary and High School Education in Tel-Aviv, Israel. 1952-1958 Medical School at Zurich University, Switzerland. From 1962 Chief Radiologist, Department of Diagnostic Radiology at the Municipal - Government Hospital "Ichilov" in Tel-Aviv, Israel. Since 1968 until now - Directing the Division of Medical Thermography of the Radiological Department of Ichilov Hospital. 1966-1967 Fellow in Radiology at Albert Einstein Medical Center, Philadelphia, USA. 1970 Visiting Faculty and Research Fellow at the Armed Forces Institute of Pathology, Walter Reed Hospital, Washington, D. C., USA. 1971 Research Fellow in Thermography at the Albert Einstein Medical Center, Philadelphia, USA. Degrees: May 1958 - Medical Degree, Nov 1967 - Specialist in Diagnostic Radiology, Tel-Aviv Medical School, Ramat Aviv, May 1973 - Senior Lecturer of Diagnostic Radiology, Tel-Aviv Medical School, Ramat Aviv. Overseas member of the American Thermographic Society.

Joel Engel M. D. Born in 1936 in Tel-Aviv. After finishing high school in Tel-Aviv and serving two and a half years in the Israeli Army, studied Medicine 6 years in Switzerland (Fribourg and Zurich). 1962 Residency in Orthopaedic Surgery in the Chaim Sheba Medical Center, Tel-Hashomer, Israel. Spent several study tours abroad for periods of up to 6 months to enlarge knowledge in Hand Surgery: 1969 Paris with R. Toubiana; 1972 Finland with K. Vanio; 1974 Louisville, USA with H. Kleinert; N.Y.C. with R. Carroll. Running a Hand Surgery Unit in the Sheba Medical Center, Tel-Hashomer since 1972.

I. Farine. Born in 1921 and completed Medical Studies in 1945. During 1946 completed internship and accepted first post in Orthopaedic Surgery in 1950. From 1946 to 1971 served as the Chief Orthopaedic Consultant for the Israeli Defence Force, and in 1971 accepted the post of Head of the Department of Orthopaedics in the Chaim Sheba Medical Center, Tel-Hashomer, Israel. In 1973 a Hand Surgery Unit was formed in the Department of Orthopaedics. At present, Head of the Department of Orthopaedics Surgery, Professor of Orthopaedic Surgery, Tel-Aviv University and national delegate of SICOT.

H. HOROCHOWSKI. Born in Paris during 1937 and educated in Paris qualifying in 1961. From 1961 until 1963 worked at the Salpêtrière Hospital in Paris. Served in Algeria during 1963 while completing his French Military service and in 1965 emigrated to Israel. Accepting a position in the Orthopaedics department Tel-Hashomer hospital associated to the University of Tel-Aviv. During the year 1969-1970 held the role of Major in the Israeli Medical Corps and served as the commander of the Military health Corp at the Suez Canal (divisional surgeon). In the course of the last few years added experience was gained while working with Dr. Müller in Bern 1971 and working with Dr. Salter in Toronto 1973 and Dr. Sheraid in Sheffield. In 1973 was appointed as a lecturer in Orthopaedic Surgery at the University of Tel-Aviv and a senior lecturer at the Military Medical School. During 1974 appointed as an orthopaedic consultant to the Israeli Defence Forces and at present deputy director of the Orthopaedic Surgery Department Chaim Sheba Medical Center, Tel-Hashomer Hospital and in charge of the children's orthopaedic unit.

Klinisches Bild des Tennisellenbogens ähnlich dem der Neuropathie des N. interosus posterior - verschiedene Ursachen - Thermographie erlaubt frühe Differenzierung - konservative Behandlung bei Tennisellenbogen - Unterscheidung zwischen kurzzeitiger oder längerer Erkrankung und Kontrolle des Erfolges einer Steroidinjektion - negatives Thermogramm bei Neuropathie, dann operative Behandlung

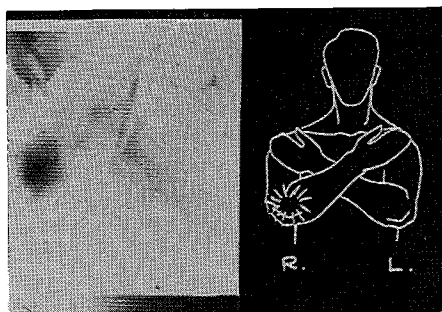
Tennis Elbow (T.E.) in our opinion incorporates numerous pathologies of different etiologies. This paper describes our diagnostic trail enabling better differentiation between similar conditions of T.E. and entrapment neuropathy of the posterior interosus nerve. Both of these cause pain in the region of the lateral humeral epicondyle radiating mainly down the dorsal side of the forearm and the hand. In both conditions, pain may appear on extension of wrist and fingers. Thermography was used by us as a differentiation tool.

## History

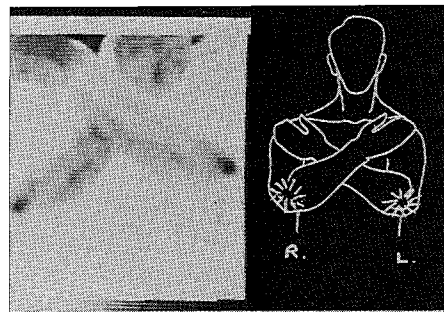
RUNGE (17) first described the disease as early as 1873. He did not call it T.E., but described the symptoms as resulting from fibrosis at the elbow region. The disease was ascribed to sporting activities, such as tennis, but it is now well known that in addition to many patients who play tennis, there are many who never did. According to NIRSCHL (2) 13% of professional tennis players do suffer from it, whereas 50% of amateur players suffered at least once from the disease. Is this due to a better grip of the tennis racket by the professional? BOSWORTH (9, 15) did not find many players among his patients. His opinion was that there are various pathologies: an extensor tendinitis, lateral humerus epicondylitis, stenosis of the orbicular ligament of the proximal radio-ulnar joint, chondromalacia of the radial head or capitulum. The combination of two or more of the above mentioned etiologies can be found on one single patient, without knowing from which it originated.

BOYD and McLEOD (14) operated on his patients with T.E. and found perostitis, bursitis, tear in the extensor origin, as well as degenerative changes in the annular ligament with traumatic situation of the elbow synovial lining. COONRAD et al. (1) define their histological findings: round cell infiltration, scattered foci of fine calcifications and scar tissue with marginal areas of cystic degeneration.

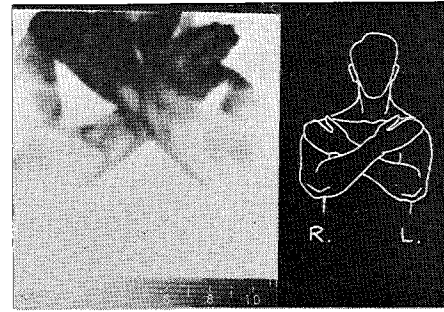
The clinical picture of T.E. is very similar to the one described as entrapment neuropathy of the posterior interosus nerve. Many authors mention the clinical similarity between the etiology which is due to mechanical pressure on the nerve and the pathogenesis which is due to a neuritis. But this has nothing in common with T.E. The were described in great detail by SPIN-NER (18, 19). Tears are described in the joint capsule due to hyperextension with scarring, which later causes en-



**Abb. 1**  
Positive thermography on right side. (Patient from Group 1).



**Abb. 2**  
Positive thermography on both sides. (Group 2).



**Abb. 3** Negative thermography. (Group 2).

trapment (10, 22). CARPENTER and CAMPBELL found when intramuscular lipomata compress the nerve, it results in a clinical picture similar to T. E. In their opinion, the reason is always an entrapment neuropathy. Other causes of compression mentioned (11, 13) were ganglion and ischaemia (4) following local injections. Rheumatoid arthritis was also found to be a cause (23). Most authors (1, 4, 5, 6) find it hard to distinguish between entrapment and T. E.

## Methods

Thermography is a diagnostic aid through which one can record and/or measure temperature at body surface (3). It is applied in the diagnosis of increased metabolic activity as well as in vascular diseases (7, 8), tumors and infections.

The human body emits infra-red rays constantly and spontaneously. These rays cannot be seen by the human eye. Through the thermograph these invisible rays, which are on the borders of the electro-magnetic spectrum (3, 20) are transferred to visible light. The picture recorded is a thermal map of the examined area. This thermogram is composed of various shades. Light shades represent hot areas and dark shades cold ones.

Any physiological or pathological change in heat emission signifies a change in tissue metabolism. These changes can be recorded in a qualitative manner through the shades on the heat map or quantitatively in degree Celsius. A change on the physiological heat map is expected after trauma, burn or tumor.

The patient stands one to three meters from the thermograph apparatus, his arms are crossed over his chest. A thermal map is recorded from both elbows for subsequent follow-up examination. The Aga Thermovision was used in all examinations. Pathology causing hyperemia or increased blood flow at the elbow region can be seen on the screen. From this diagnosis and evaluation of treatment can be done.

Thermography is an easy, quick and non-harmful examination of the patient and can be repeated without any risk.

## Results

42 patients in whom Tennis Elbow was suspected were examined by thermography. The results were always most informative. One could say by the results whether the patient will suffer from T. E. for a long or short period or, if the problem is the posterior interosseous nerve entrapment and not T. E.

## Examples:

### Group 1

T. E. of long duration (Above three months).

1. G. W. housewife – excessive heat radiation from painful right elbow (fig. 1). Two months after local injections of steroids, clinically improved, thermography radiation compared to the previous examination decreased. Six months after injections, heat radiation normal.

2. M. W., housewife – painful elbow radiating excessive heat, seen clinically and thermographically. Improved four months after injection. Slight thermographic effect will still be present after six months.

### Group 2

T. E. of short duration (Less than three months).

3. C. M., violinist – thermography of painful elbow-negative. Pains stop without treatment within two weeks.

4. L. X., army officer – thermography of painful elbow negative. Symptoms decreased following steroid injection after three weeks.

5. L. E., businessman – slight thermographic changes. Pain disappeared after one local steroid injection and the thermoid map becomes normal.

6. K. M., plumber – clinically painful on both elbows. Thermography positive (Fig. 2). Clinical and thermographic effect disappeared after two months of conservative treatment.

7. S. A., housewife – no thermographic effect at a slightly tender elbow. Tenderness disappeared with no treatment.

### Group 3

Entrapment Neuropathy.

8. M. A., housewife – clinically severe pain, resistant to conservative treatment. Thermal map – negative (Fig. 3). E. M. G. (Electromyography) indicated posterior interosseous nerve entrapment.

9. B. M., army officer – very tender elbow. Thermography negative. E. M. G. points to entrapment neuropathy. No pains following operation.

Repeated thermal screenings were performed in order to eliminate any local findings due to any treatment.

Conservative treatment of T. E. included analgetics, anti-rheumatic drugs, splinting, heat and local steroid injections.

## Discussion

The therapeutic approach for the two clinical pictures is different; whereas an entrapment neuropathy should be treated by surgical release, Tennis Elbow can be approached by conservative treatment including rest, steroid injections and other measures. According to GARDEN (16), only after failure of non-surgical treatment should the patient be operated upon in one of the various ways. It is possible that an operation to release one condition, might help if the other one is present. Still, early diagnosis and differentiation between both conditions should be stressed. From our material it seems that positive thermography accompanies the clinical picture of T. E. of longer duration. An improvement of the thermographic findings, i. e. less heat emis-

sion, will lag after a period of two months. The relief of symptoms clinically will precede the improvement on the thermal map. (Group 1). In patients in whom T. E. existed only for a short duration (a couple of weeks) the thermal map was equivocal. (Group 2). In the entrapment neuropathy cases, where pain is resistant to treatment, we may conclude that thermographic examination distinguishes between T. E. of longer duration and nerve entrapment.

SHILO, R., J. ENGEL, I. FARIN, and H. HOROCHOWSKI: Thermography as a Diagnostic Aid in Tennis Elbow.

# Summary:

Thermal screening was used in order to distinguish between Tennis Elbow and entrapment of posterior interosseous nerve. Both conditions have a very similar clinical picture but there should be an altogether different approach concerning treatment. The differential diagnosis is therefore of great importance and thermography of the elbow is a valuable aid in this distinction.

SHILO, R., J. ENGEL, I. FARIN und H. HOROCHOWSKI: Thermographie als diagnostische Hilfe beim "Tennis-ellenbogen".

# Zusammenfassung:

Schmerzen im lateralen Ellenbogenbereich werden meistens einem Zustand, der "Tennisellenbogen" genannt wird, zugeschrieben. Diese Krankheit, die zuerst vor zirka 100 Jahren in der deutschen Literatur als Schreibkrampf beschrieben wird, wird heute häufig bei Hausfrauen, manuellen Arbeitern und Tennisspielern gefunden. Druck auf den Nervus radialis im Ellenbogen gelenk ist nicht selten. Die Symptomatologie ist oft identisch, dagegen ist die Therapie verschieden. Der mechanische Druck bei der Neuropathie des Nervus radialis soll so früh wie möglich operativ beseitigt werden. Dagegen soll der Zustand, der als "Tennisellenbogen" bekannt ist, konservativ behandelt werden. Die Thermographie erlaubt das Frühdifferenzieren dieser Krankheiten.

SHILO, R., J. ENGEL, I. FARIN et H. HOROCHOWSKI: Le rôle de la thermographie comme examen complémentaire du diagnostic du "tennis elbow".

# Résumé:

Le "tennis elbow" se définit comme un état douloureux de l'épicondyle. La description originale en langue allemande date d'environ cent ans. Ce syndrome était alors fréquemment diagnostiqué parmi les fonctionnaires et désigné comme "la crampe des écrivains". De nos jours l'épicondylite semble être plus fréquente chez la ménagère, les travailleurs manuels et les joueurs de tennis. La symptomatologie de la compression du nerf radial au niveau du coude est souvent identique à celle de l'épicondylite, sa fréquence n'est pas rare, par contre le traitement en est fondamentalement différent: tandis que l'épicondylite est susceptible de répondre favorablement au traitement conservateur, la compression du nerf radial exige comme traitement unique: la décompression.

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Anschrift der Verfasser:

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Tel-Hashomer/Israel

## Referate

IRELAND, D. C. R., N. TAKAYAMA, and  
A. E. FLATT  
(Iowa City, Iowa):  
Das Poland-Syndrom  
(Poland's Syndrome)  
J. Bone Jt Surg. 58-A, 52-58 (1976)

Das 1841 von POLAND beschriebene Syndrom beinhaltet Thoraxanomalien in Verbindung mit gleichseitigen Syndaktylien unterschiedlicher Ausprägung – meist jedoch Veränderungen im Sinne einer Symbrachymesophalangie.

Die Ätiologie ist unbekannt, offenbar besteht keine Erbllichkeit. Bei etwa 6–9% (Ergebnisse aus zwei repräsentativen Untersuchungsreihen) aller Patienten mit Syndaktylien finden sich zusätzliche Thoraxveränderungen im Sinne eines Poland-Syndroms. Diese bestehen in Hypo- oder Aplasie der Pektoralismuskeln, der Brust und der Brustwarze, Hypoplasie der proximalen Rippen, Pectus excavatum oder carinatum, Schulterblatthochstand, Skoliose, Zwerchfellhernie und Flügelfellbildung der vorderen Achselhöhlenbegrenzung. Auch der Arm ist hypoplastisch; die rechte Seite ist häufiger als die linke betroffen.

In der besprochenen Arbeit wird über 31 männliche und 12 weibliche Patienten mit Poland-Syndrom berichtet, die von 1930 bis 1974 am University Hospital in Iowa City behandelt worden waren; 29 konnten nachuntersucht bzw. befragt werden.

Bei allen 43 Patienten fehlte der sternkostale Anteil des M. pectoralis major, der M. pectoralis minor fehlte bei 15. Die Brustwarze war meist hypoplastisch, jedoch immer vorhanden. 3 Patienten hatten röntgenologische Rippenveränderungen, 4 eine Zwerchfellhernie. Ein Patient hatte eine rechtskonvexe Thorakalskoliose und Halsrippen; bei 2 Patienten lag eine Dextrokardie vor. Das Ausmaß der Schädigung im Thorakalbereich war proportional zu der Hypoplasie der gleichseitigen Extremität. Von 19 Patienten hatten 5 eine Armlängenverkürzung bis zu 3 cm, die restlichen von 8–14 cm. Zusätzlich wurden verschiedene Fehlbildungen im Skelettbereich wie Hypoplasie des Radius oder der Ulna, des proximalen Radio-Ulnar-Gelenkes bzw. radio-ulnäre Synostose und Subluxation im Humero-Ulnar-Gelenk beobachtet. 36 Patienten wiesen Hypoplasien des Karpalbereiches auf. 27 Patienten hatten partielle oder komplette Syndaktylien aller Finger, wobei die erste Kommissur gewöhnlich am wenigsten betroffen war. Bei 8 Patienten waren drei, bei 5 zwei und bei 3 Patienten eine Kommissur betroffen. 37 von 145 Kommissuren waren komplett, 108 inkomplett syndaktyl ausgebildet. Fast immer bestand eine ausgeprägte Finger-Hypoplasie, oft fehlte die mittlere Phalanx – auch bei nicht von der Syndaktylie betroffenen Fingern. 28 mal war der Daumen unterentwickelt und seine Funktion eingeschränkt.

Bei 8 Patienten wurden verschiedene Finger amputiert; 51 Trennungsoperationen in verschiedenen Techniken und 46 Revisionsoperationen (davon 37 erneute Kommissurbildungen) wurden ausgeführt.

Die Ergebnisse wurden nach Funktion und Kosmetik sowohl von Patienten bzw. Eltern als auch vom untersuchenden Arzt beurteilt.

Zum operativen Vorgehen erscheint bemerkenswert, daß die Autoren bei frühzeitiger Trennung der Finger die Fingerarterienbifurkation erhalten aus Sorge um die Blutversorgung im Hinblick auf später erforderliche Korrekturen (ein Vorgehen, das der Referent **nicht** befürwortet, weil eine schon primär insuffiziente Kommissurbildung zum sicheren Rezidiv führt).

Nach einer ausführlichen Einzelfallbeschreibung kommen die Autoren zu dem Schluß, daß das Poland-Syndrom möglicherweise durch prädisponierte Überreaktion auf teratogene Umweltfaktoren zurückzuführen ist; der Defekt muß vor der eigentlichen Segmentation im mesenchymal angelegten Phalangenbereich liegen.

Das mit 50% sehr gute bis befriedigende Ergebnis der Fingerkorrekturen wird in Anbetracht der funktionellen und kosmetischen Verbesserung von einer Beihand zu einer nutzvollen unabhängig funktionierenden Hand als zufriedenstellend betrachtet.

G. NEFF, Heidelberg

SUGIURA, I.  
(Nagoya University School of Medicine,  
Nagoya, Japan):  
Intraossärer Glomustumor  
(Intra-Osseus Glomus Tumour).  
J. Bone Jt Surg. 58-B, 245-247 (1976)

Nach einer Statistik der Mayo-Klinik fand sich der Glomustumor unter 500 Weichteiltumoren der Gliedmaßen nur in 1,6%. Bisher wurde in der Weltliteratur (angeblich) nur in 8 Fällen ein intraossäres Auftreten beschrieben. Differentialdiagnostisch sind – aus röntnologischer Sicht – die Epithelzyste, das Enchondrom, eine chronische Osteomyelitis oder Sarkoidose, histopathologisch Hämangiome, Neurofibrom, Neurom und Melanoblastom auszuschließen. Die Behandlung besteht in der Kurettage, die Endgliedamputation scheint ein zu heroischer Eingriff.

E. SCHARIZER, Mannheim