

Study on postburn hand sensation using a personal test*

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Summary. Using clinical tests, the authors have studied the recovery of sensation following *third degree burns* after excision to the subdermal area or the “fascia”. This study is comprised of 57 hands. The part of the body to be examined was deliberately limited: the hand was selected because of its unique anatomical and functional features. Most frequently, the burns were on the dorsum of the hand; the palm was involved less frequently, mainly in children. The test performed was designed to assess prick (pain) and touch without the help of sight. It also explored the ability to discriminate. The results were graded by numbers from 0 to 4, i.e. from anesthesia to perfect discrimination. The examinations were performed some months to some years after the initial accident. The results *clearly show* that grade 4 is never reached, and that in some cases protective sensation is absent.

Key words: Hand – Post-burn – Sensory test

In 1981, at the European Congress of Physiotherapy in Liège (Belgium) [4], we addressed the question of hand sensation for the first time. In collaboration with a French physiotherapist [5], who based his opinion on Mansat's [7–9], Dellon's [1–3], Delprat's [7–9] and Weber's [14] studies, hand sensation after nerve lesions was explored proposing a treatment by brushing.

In 1989, with a grant from the Belgian Association for Burn Injuries, and at the request of our surgeons, a study on the burned hand was undertaken, especially following *deep burn injuries*.

The difficulty is to “standardize” third degree burns on the back of the hand because of the different depth of various sensory receptors (appendages).

The hand was chosen for this test because of its unique functional role. The assessment of postburn impairments is particularly critical in this particular anatomic area.

The test has been performed on 57 hands [6]. A thesis for the paramedic's diploma has been jointly presented with our own study to answer the following question: what is the sensory loss after third degree burns on the back (palm also) of the hand?

Materials and methods (Tables 1–3)

From a simple test performed with a very ordinary tool – a paper clip – we have been able to obtain some accurate information. The required tool is simple:

- a cardboard box with a cutout because the test is performed without the help of sight
- a paper clip
- a ruler

The general conditions:

- a well heated and quiet room
- the hand must be well exercised prior to the study (thus, do not start with the hand cold)

Test 1: Prick

With the spread-out paper clip, the examiner slowly pricks the part of the hand to be explored until a light white ring appears on the skin. The test is to be repeated several times and slowly.

N.B. In theory, the test should be conducted on a healthy neighboring part of the hand, which unfortunately is not always possible. The answer must be clear: prick or nothing.

Test 2: Touch

With the circled side of the paper clip, the examiner “rubs” the areas to be explored several times and slowly. The answer must be clear: “rub”, “touch” or nothing.

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* Modified Weber's test [14]

Table 1. General statistics on 57 hands

19	11 Men : age :	5 years → 61 years
	8 Women : age :	14 years → 64 years
	1 examination :	Men : 8 × Women : 4 ×
19	2 examinations :	Men : 3 × Women : 2 ×
	3 examinations :	Men : 0 × Women : 2 ×
	2 burned hands	Men : 10 × Women : 7 ×
	<i>Shortest period test</i>	<i>Longest period test</i>
	Men After 29 days	→ After 6 years
	Women After 2 1/2 months	→ After 7 years
57	back of the hand test : 45 × palm of the hand test : 12 ×	

Table 2. General statistics about each patient (men)

Name	Age at the moment of the accident	Moment of the examination	Number of examinations	Total amount of tested sides
1 TH.M	32 years 1/2	After 29 days	1	2
2 D.P	29 years	32 days	1	2
3 V.D	25 years	40 days	1	2
4 N.TH	33 years	3 months	1	2
5 C.D	21 years	5 months 1/2	1	2
6 St.D	35 years	a) 5 months 1/2 b) 10 months	2	4
7 H.A	61 years	6 months	1	2
8 L.J	37 years	a) 6 months b) 15 months	2	4
9 G.A	39 years	a) 8 months b) 2 years 2 months	2	4
10 L.F	8 years	3 years	1	2
11 S.P	16 years	16 months	1	2

Table 3. General statistics about each patient (women)

Name	Age at the moment of the accident	Moment of the examination	Number of examinations	Total amount of tested sides
12 E.M.	32 years	a) after 2 months 1/2 b) after 8 months 1/2	2	2
13 J.M.	64 years	a) 3 months 1/2 b) 4 months c) 12 months	3	7
14 G.TH	60 years	4 months	1	4
15 P.M.	44 years	a) 5 months b) 8 months c) 29 months	3	5
16 B.N.	32 years	a) 9 months b) 13 months	2	6
17 B.M.	14 years	13 months 1/2	1	2
18 F.A.	40 years	17 months	1	2
19 Ch.C	28 years	7 years	1	1

Table 4. General results

	Men	Women
Graduation 0	3 ×	3 ×
Graduation 1	3 ×	2 ×
Graduation 2	3 ×	6 ×
Graduation 3	3 ×	3 ×
Graduation 3 +	7 ×	6 ×
(Graduation 4 –	4 ×	2 ×)
Graduation 4	0 ×	0 ×

Table 5. Results: graduation for each patient (men)

Name	Right side	Left side
1 TH.M	D ^a : SO → S3+	D: S3+ → S4–
2 D.P	D: S1 → S3	D: S2 → S3+
3 Vi.D	D: S2 → S3+	/
	P ^b : S2 → S2+	/
4 N.TH	D: S3+	P: S3+
5 C.D	D: S3+ → S4–	D: SO → S3+
6 St.D	a) P SO → S3+	a) P SO → S3+
	D SO → S4–	
	b) D S2 ?	b) D: SO → S1
7 H.A	D: S3+	D: S1+
8 L.J	a) D: S3+	D: S3+
	b) D: S3	D: S4–
9 G.A	a) D: SO → S3	D: SO → S3+
	b) D: SO → S3+	D: SO → S3+
10 L.F	D: S3+	D: S4–
11 S.P	D: S1+	D: S1 → S2

^a dorsal^b palm**Table 6.** Results: graduations for each patient (women)

Name	Right side	Left side
12 E.M.	/	a) P SO → S3+
	/	b) P SO → S3+
13 J.M.	a) D S2 →	a) P S3+
	b) D S2 →	b) P S2 → S3
	c) D S2 →	b) D S4–
14 G.TH	D S2 → S3	/
	P S2	D S1
15 P.M.	a) D /	P S2 → S3
	b) D: S3 → S4–	a) D: S3
	c) D: S3 → S4–	b) D: S2 → S3+
16 B.N	a) D: S2 → S3+	c) D: S2 → S3
	P: S3+	D: S2 → S3+
	b) D: S3 → S3+	P: S2 → S3+
17 B.M	D: S2 → S3+	D: S3+
18 F.A.	D: S1+ ?	D: S2 → S3+
19 Ch.C	D: S1 → S2	D: S1+ ?

Test 3: Determining two point discrimination

With both ends of the twisted paper clip spread out (3 cm maximum), the examiner pricks the part of the hand to be explored just as in Test 1.

N.B.: The test must be repeated with smaller and smaller spaces gradually approaching the normal level. The answer must be clear: 1 or 2 pricks.

Graduation: Scale*

S0: anesthesia

S1: prick

S2: prick and touch with unpleasant sensation

S3: prick and touch: no change but lack of discrimination

S3+: as S3 but inaccurate determination (discrimination)

S4: as S3+ but accurate determination

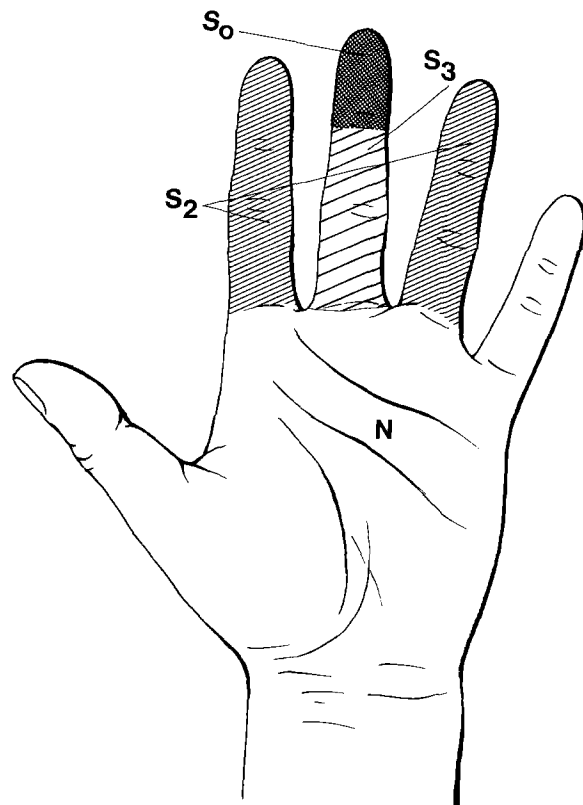
N.B.: normal values for a perfect discrimination:

* back of hand 8–10 mm, palm of hand 2–4 mm

Results (Tables 4–6)**Interpretation of the test**

S0–S2: Protective sensation is not reached.

S3: The patient has difficulty in appreciating “fine” movements (during the test, the space between the two points is much too big; so, no, discrimination at the two points.)

**Fig. 1.** Diagram of tests on a left hand, palm (Table 3, patient no. 12). Result (excerpt from Jouret's memoir, p 145)

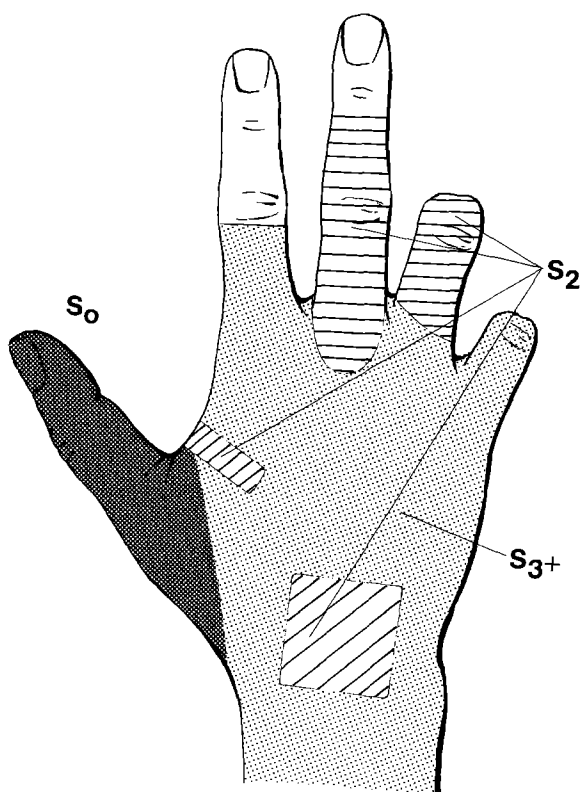


Fig. 2. Diagram of tests on a right hand, dorsum (Table 2, patient no. 6). Result (excerpt from Jouret's memoir)

S3+ : the space between the two points is reduced but not yet normal: poor discrimination
 S4: normal sensation, perfect discrimination (Figs. 1, 2).

Discussion

The test can take from 20–30 min per hand, and in spite of its simplicity, the patient is sometimes tense and anxious, thus he can be disturbed and give vague answers. We remember a patient who did not answer, another patient who said, "It tickles, I feel a little, I feel you're pressing,"; whereas the answer must be clear: prick, rub or nothing.

The burned hands to be tested have different characteristics:

- uniformly burned hands
- partly burned hands
- sometimes very thick hypertrophic scars
- Web space deformities with contraction of the commissures
- presence of various amputations
- presence of deformations (swan neck, mallet-finger, etc.)
- denudation of the extensor tendons
- palm hyperhidrosis
- rounded hand by contraction of the palm

Several hands present anesthetic zones (Table 2, patients no. 1, 5, 6, 9; Table 3, patient no. 12) or low graduation to S2 as the patient does not get to the level of protective sensation (Table 2, patient no. 11; Table 3,

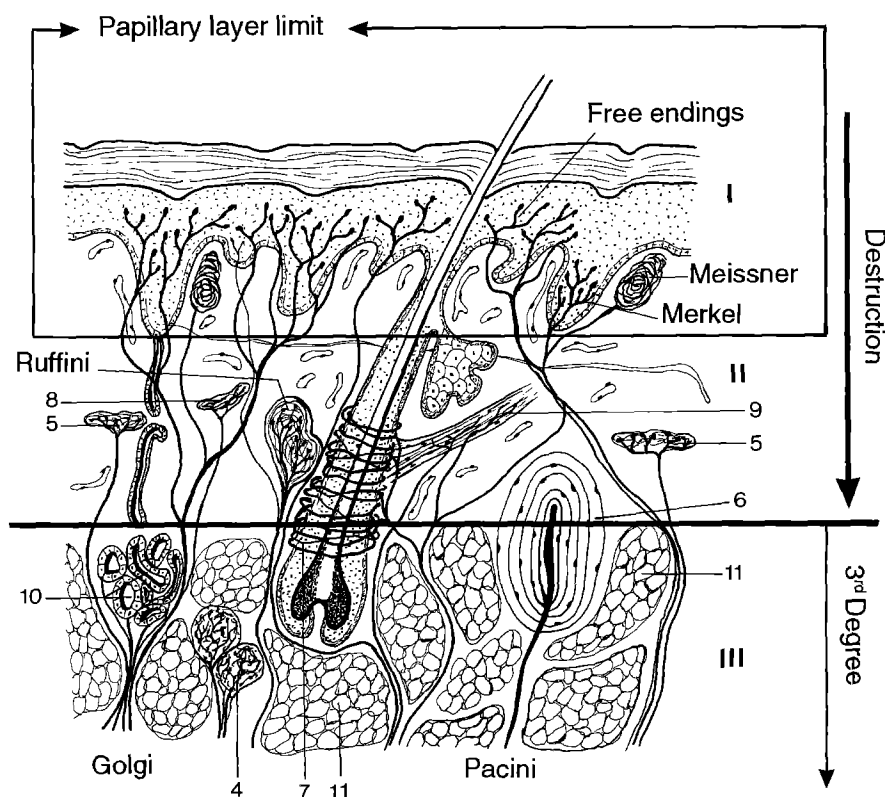


Fig. 3. Skin cut: third degree burns; still several grades of depth and degrees of damage (sensory appendages: conservation or not)

patients no. 17, 18, 19). He confuses prick and touch or he only feels a light pressure to whatever the paper clip manipulation.

A practical confirmation of these observations is given to us by the patient with scratch marks proving an unsatisfactory sensation: the patient points out some difficulties in performing odd jobs (Table 2, patient no. 11) (driving a motorcycle), moving furniture (Table 3, patient no. 19), keeping the house in order (Table 3, patient no. 18), e.g. peeling potatoes or cutting meat.

Several patients exhibit hyper- and or hyposensitivity to warm and/or cold and also to prick.

It is paradoxical to discover that among these patients, some show "dexterity", but we must not forget that they can use their sight and that those gestures require automatism; besides, some patients must imperatively get a result which inconveniences, e.g., the act of dropping things and breaking them, or the awkwardness of several trials to get the final results.

With burned skin, the more or less severe sensory damage seems to be an *established fact*. About the possible "recovery", it seems *problematic* even month after month and year after year; one need only refer to the statistics to be convinced.

On the other hand, suggesting that younger patients are able to recover better is a little hasty (Table 2, patient no. 10; Table 3, patients no. 13, 15). Nevertheless, the *immediate conservation* of satisfactory sensation seems to be effective and permanent: the test at the beginning of progress proves it. That is the reason why we can ask the question: are there no sensory differences (touch, gradation) to precisely establish the depth called third degree?

Histological skin section and papillary layer of the epidermidis (Fig. 3)

The examination of a histological section of the skin and its sensory appendages shows how much the initial trauma, escharectomy or tangential excision, can for some tenths of millimeters determine the *future sensation* of a hand.

It is the same for the graduation scale of the ability to discriminate: between S3, S3+ and S4 are there not several differences to distinguish? How can we explain a discrimination of the two points at 3 cms, 2 cms and even 1 cm otherwise than the graduation S3 (lack of discrimination) or S3+ (poor discrimination) when 0.8 cm is considered as normal?

If we accept the differences, there is sometimes *improvement* but is it not particularly *subjective* and after all reduced?

Finally, we will end our comments by a fact: there is sometimes regression (Table 2, patient no. 8; Table 3, patients no. 13 & 15) of sensation after an operation.

Conclusions

Our study on sensation has provided a clear understanding of the recovery after deep burn injuries. Such findings are similar to those published previously [11–13].

In final conclusion, we suggest that the modified Weber test covers the whole range of sensation from anesthesia to perfect discrimination. It allows us to have a rather precise idea about sensation of the burned hand. Although the test is simple, it seems to be appropriate and satisfactory. Nevertheless, it does not *replace all the more precise tests* that already have proven their usefulness (especially the ninhydrin test) [10] f.e. in expert appraisal (opinion or valuation).

It is in fact a *good starting point* for reeducation, because it is *easily* performed by any therapist.

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