

Measuring of electrical voltage differences during fracture-healing : preliminary report

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MEASURING OF ELECTRICAL VOLTAGE DIFFERENCES DURING FRACTURE-
HEALING. PRELIMINARY REPORT.

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Since the time it has been generally received that electrical phenomena may influence bone-fracture healing, measuring methods are being sought through which an insight can be gained into that influence.

The background of the research, reflected in this contribution, is the collecting of electrical measuring-data from patients such that life-processes will not be influenced when making measurements

That group of patients has been chosen with whom a tibia-fracture is being fixed by means of the Hoffmann Fixateur Externe.

In this case proximately and distally of the fracture-face screws are fixed in the bone. These screws are passing outward through the skin.

Externally these screws are connected rigidly, whereas with respect to each other they are electrically insulated. The electrical voltage differences between the screws have been measured, in which case the screw lying proximately nearest to the fracture-face, has been taken as a reference. The electrical

voltage differences between the reference-screw and three spots on the skin have been measured as well. This has been done by means of a rustproof steel plate-electrode (30 x 130 mm) with an electrode-paste fil on it.

For measuring, a volt-meter having an input-impedance $> 1000 \text{ M}\Omega$, has been used. Experimentally it has been determined that this large input-impedance is such that this volt-meter's influence on the measuring results can be neglected.

The measurements have been made on 15 patients, once a week at a fixed point of time, from the Fixateur-Externe being fixed until it is taken away. The measuring period varies between 7 and 18 weeks.

In Fig. 1 the voltage differences ΔV with respect to screw no. 3 of a certain patient are shown as a function of the locations of the screws.

In order to have the measuring data represented surveyably, the following magnitudes have been calculated :

1. The average (ΔV_{av}) of the ΔV 's measured on one day
2. The standard deviation $\sigma_{\Delta V}$ in the ΔV 's with respect to ΔV_{av} .

For the same patient, in Fig. 2 are shown ΔV_{av} and $\sigma_{\Delta V}$ as functions of time. From about 3 weeks after the origin of the fracture the changes in ΔV_{av} and $\sigma_{\Delta V}$ are becoming considerably smaller than the changes which took place during the first three weeks.

Similar ΔV_{av} and $\sigma_{\Delta V}$ relations as functions of time have been observed with all 15 patients.

This point of time broadly corresponds with the point of time at which it is generally assumed that ossification starts.

Examining the fact whether the determination of the beginning of ossification can be derived from the measuring of voltage differences at the Hoffmann-Fixateur-Extern, should be recommended.

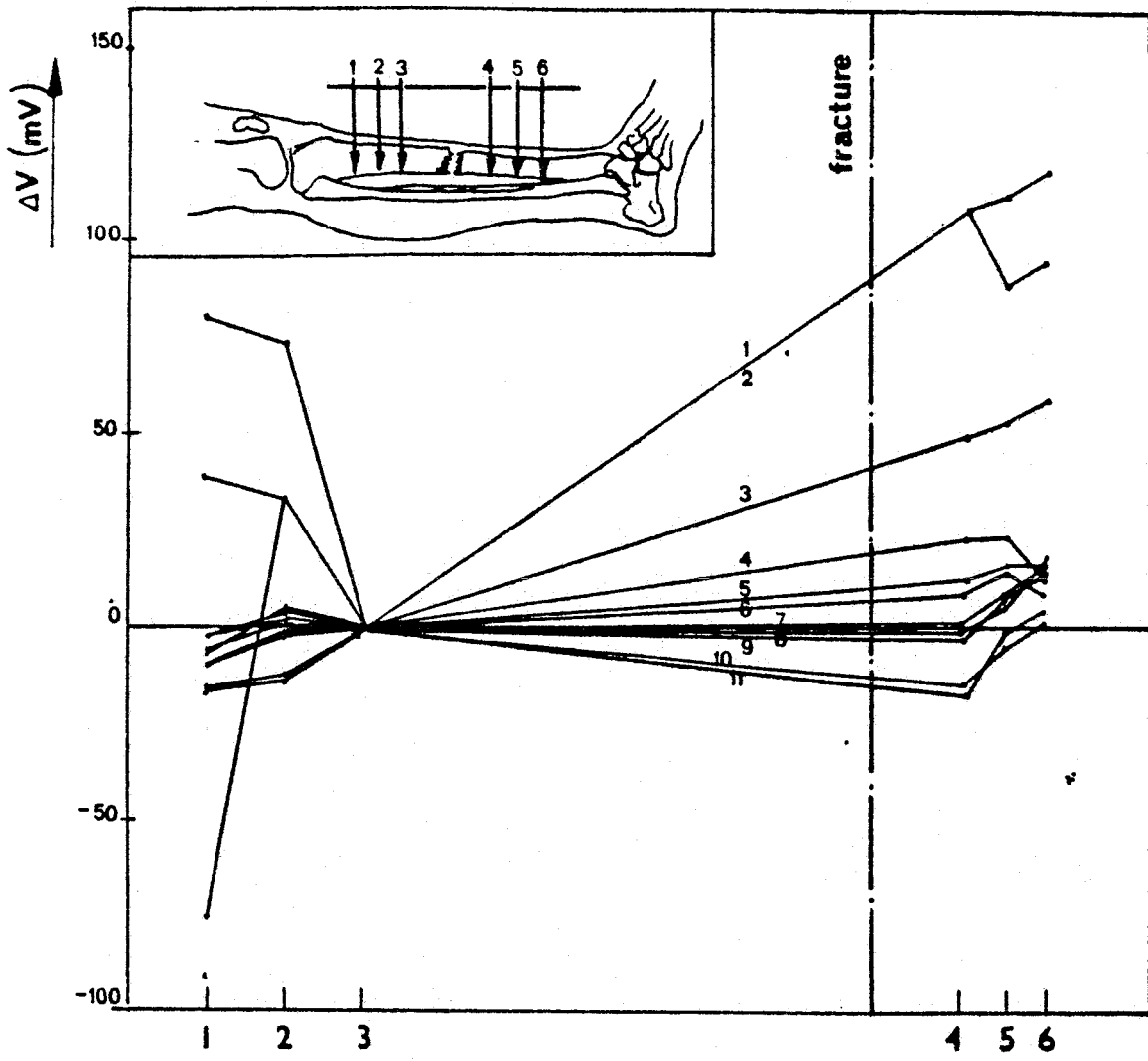


figure 1.

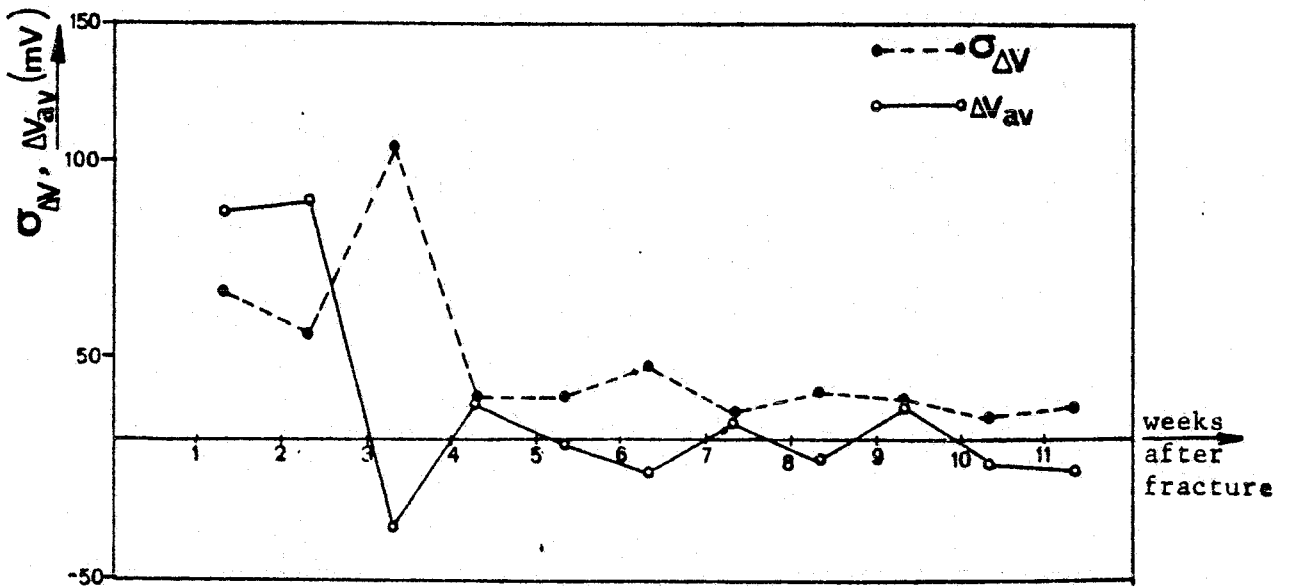


Figure 2.