HISTOCHEMICAL, ELECTRON MICROSCOPIC AND MICROANALYTIC INVESTIGATIONS OF TISSUE SURROUNDING NI-CR-ALLENTHESIS IN MAXILLO-FACIAL SURGERY

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INTRODUCTION

Special metal devices can be suited for a temporary alloplasty and for the fixation and stabilization of fractured bone structures. Due to their good electroconductivity, however, metals tend to corrode by electrochemical processes. Special alloys are manufactured for surgical purposes. Because of their composition and homogeneity, these alloys are claimed to be electroenergetically inactive and chemically resistant. However, this holds true only if the passive surface layer is intact. Because the surface layer in steel alloys is only 1/200 000 mm thick, the question arises, whether it can act as a barrier under biological conditions. Repeatedly, metallotic damage to the surrounding tissue and fracture of the plates have been reported (Frank and Zitter, 1971; Schuster, 1970, 1975; Münzenberg et al., 1972). The question arises, to what extent corrosive processes account for these problems.

MATERIAL AND METHODS

In 4 patients mandibular reconstruction plates had to be removed because of soft tissue necrosis with exposure of the allenthesis (n=2) and osteolysis in the screw area (n=2). The plates were in position for 6 - 14 months. During surgical reintervention biopsies were retrieved from the surrounding tissue, 4 samples for histochemical and 12 samples for electron-microscopical investigations from each patient. Specimen were taken with a certain distance to the screws to exclude influences due to crevice and abrasion corrosion, and well away from the area of plate exposure. The adjacent soft tissue did not exhibit any metallotic discolouring. The preparation procedure of the tissue samples for histochemical, electron microscopic and microanalytic investigation are described in detail elsewhere (Dielert et al., 1981). The chemical composition of the plate alloy (X5 Cr Ni Mo 18/12; DIN 17006) is Fe 62, Cr 17.5, Ni 12.0, Mo 2.5, Mn<3, Si<3, C 0.03 weight percent.

HISTOCHEMISTRY

Ferric ions can be identified with potassium ferrocyanide and ferrous ions with potassium ferricyanide by the resulting blue color. With light microscopy small non-translucent particles are seen with a blue reaction in the vicinity (fig. 1). These pictures, however, cannot answer the
question whether the iron determined by the blue reaction originates from hematoma or from the allenthesis.

TRANSMISSION ELECTRON MICROSCOPY

The next step to answer this question consisted in transmission electron microscopic investigations. The particles varied from 0.01 to 20 microns in size (fig. 2). Their shape was often comparable to that of the grains found in plate surface micrographs. Foreign material could also be detected lying inside histiocytes and fibrocytes (fig. 3).