Temperature values in bone tissue during implantation of self-curing polymethylmethacrylate

TEMPERATURE VALUES IN BONE TISSUE DURING IMPLANTATION OF SELF-CURING POLYMETHYLMETHACRYLATE.

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It is still questionable as to what extend the heat generated within self-curing bone cements (PMMA), as used in Orthopaedic Surgery, damages the living bone tissue. Experimental measurements and histological studies have resulted in contradictional opinions.

Most probable many differences in results are due to different experimental circumstances ; also in clinical use the circumstance will vary in such a way that no definite statement can be expected. These circumstances are determinated by the amount and velocity of heat release, thermodynamical properties of the cement and the surrounding materials, initial and ambient temperatures and the geometrical properties of implant and bone.

As has been previously reported (1), a method of analysis was developed to evaluate the influence of these parameters on the nonsteady temperature values in the cement and the surrounding implants and tissues. This method uses mathematical computer simulation.

The method has been refined to take contact heat resistances into account and was used to calculate temperatures as function of time in the bone tissue during the implantation procedure. Also the influence of the vascularisation was simulated.

It will be shown that, while the temperature values inside cement masses can be as high as 125°C, the values inside the bone are considerably lower ; under unfavorable conditions they can be high enough for a long enough time to cause tissue damage, but then only in a small zone of a few mm near the cement-bone interface. These unfavorable conditions can be quite clearly specified, so that criteria for implantation techniques can be derived.

References.

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