ACTIVE MECHANISM OF PULSED SIGNAL THERAPY

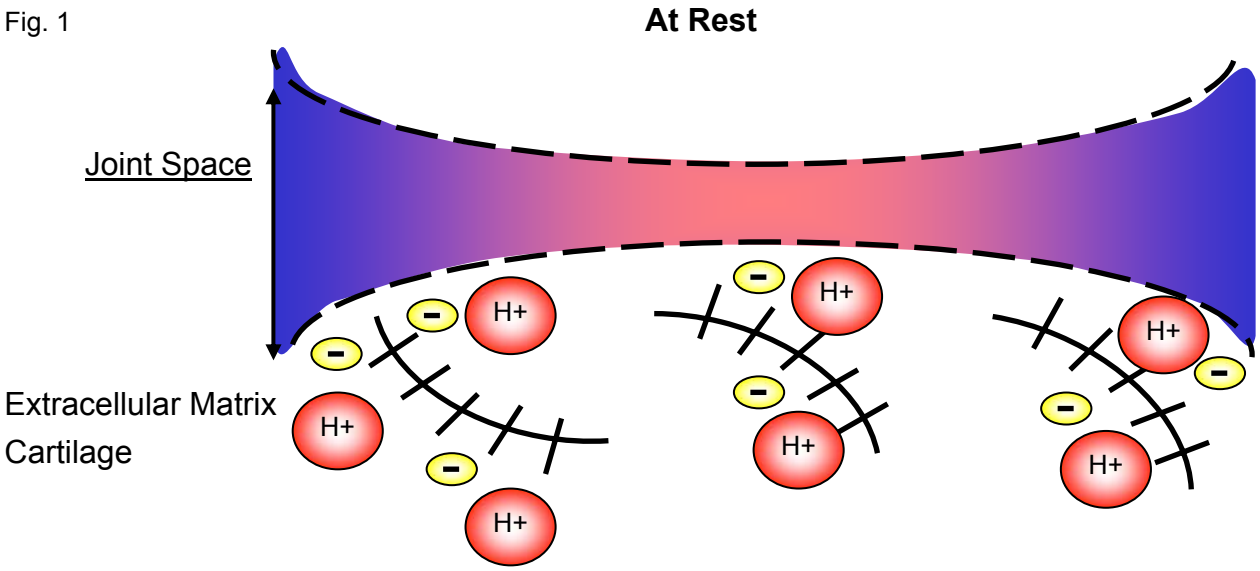
Potential Flow in the joint

The active principle of PST relies on the creation of a flow of voltage potentials, which is illustrated in the accompanying schematic representation.

In analogy with rebuilding processes in bone tissue, where piezo-electric pulses, among others play a considerable role in the control of osteoblast and osteoclast activity, in all probability voltage potential flows in the region of the joints and of cartilage tissue, so-called streaming potential or Zeta potentials play a similar role.

The hydrogen protons and hydrogen cations of the joint fluid, which in the rest state mostly stay in the vicinity of negative groups of the extracellular matrix (ECM) as a result of electric attraction, are of prime importance here.

Fig. 1



Charge equilibrium between hydrogen protons and negative charge carriers in the extracellular cartilage metrix

Under compressioon, water in a joint is forced out of the cartilage through the pressure transmission created between the two joint surfaces

Flexing of cartilage tissue under pressure is a decisive factor for the nourishment of cartilage cells with synovial fluid, since the cartilage itself has no blood vessels. The hydrogen protons are carried along with the resulting fluid flow. This leads to the creation of a so-called streaming potential flow or voltage potential in the joint. Overall, this potential flow builds up an electric field around each joint. In nearly all cases of joint damage, mainly in degenerative diseases, the formation of these potential flows is lowered and reduced. The result is that the electric field around the joint is disturbed. Thus the continuous stimulation of the chondrocytes to regenerate the matrix components is reduced.

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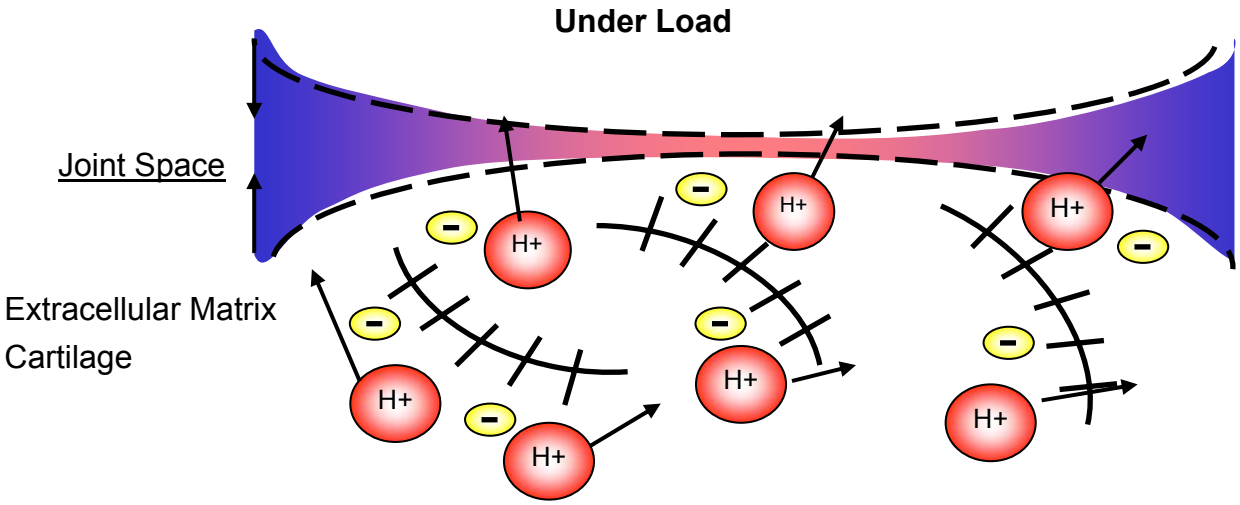
Fig. 2

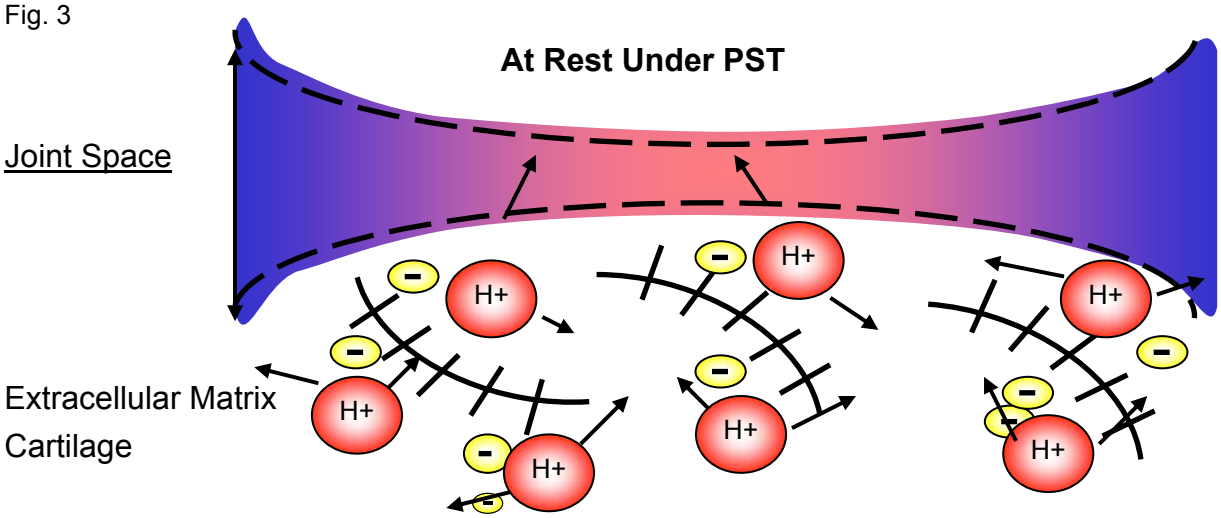


Creation of a streaming voltage potential in the ECM during loading caused by the "compression" of fixed negativ charged fluid forced out of cartilage tissue with forced movement displacement of the hydrogen protons (joint flexion)

Application of the active mechanism:

At rest, when not under load, PST generates many different potential flows in the joint. This is achieved through a changing pattern of rectangular pulses, whereby hydrogen protons are forced to undergo completely different movements in the joint region. As a result, great many multi-directional potential flows are invoked, which lead to increased chondrocyte activity.

Fig. 3



Generation of Streaming Potentials flow in the Joint caused by forced movement of hydrogen protons in the ECM through alternating PST signals as stimulation of chondrocytes in the connective tissue matrix