CONDUCTIVE ELECTROLYTE GELS COMPARED

Conductive electrolyte gels play the important role of coupling the electrotherapeutic instrument and the electrode to the biological tissue. The greater the electrical conductivity (or, the lesser the electrical resistance of the gel), the greater the effectiveness of this coupling at the electrode-tissue interface, both for monitoring and for delivering pulses of electrical current for electrotherapeutic purposes. If the conductivity of the electrolyte gel at the electrode-tissue interface is not very high, it will be absorbed into the outermost layer of dead cells (called the stratum corneum), but the electrical resistance of the skin will end up being higher than if a more effective gel were used. This situation requires a higher pulse voltage to drive the same current through the tissue, and it could conceivably cause the patient to experience a "prickling" sensation in small regions of the skin where the current density may be unusually high. This can be alleviated by a highly conductive gel if it is absorbed into the stratum corneum in a fashion that causes the current density under the electrode surface to be more uniformly distributed.

Four different electrode gels (from three manufacturers) were compared for their specific conductivity (in milliSiemens per cm., formerly called milliohms per cm.), by measuring an ac current through, and the corresponding ac voltage across, the gel. A 1 cubic centimeter cavity was accurately machined in nylon plastic, and two polished brass alloy electrodes (Electro-Medical, Inc.) were placed on either side. Five different frequencies from 10Hz to 100kHz, currents less than 800 microamperes, and voltages less than 90 millivolts across the gel were used. The following results show that at 10 Hz the specific conductivity of CEL-071 gel is 5.7 times the specific conductivity of Parker Tensive Gel, its closest competitor. At 100kHz, the specific conductivity is 4.9 times the specific conductivity of Pharmaceutical Innovations Lectron II gel, the best performing competitor at that frequency. Over the entire frequency range tested (only two frequencies are listed below), CEL-071 gel always has a specific conductivity between 2.2 and 5.7 times better than its nearest competitor.

The specific conductivity of tap water (Seal Beach, CA) was also tested, and its specific conductivity was found to be only 17% to 60% of that of the poorest performing gel, depending upon the frequency used for testing. If the specific conductivity of CEL-071 gel is compared with that of tap water, it is found that CEL-071 gel has between 27 and 78 times the corresponding values for tap water, depending upon the frequency used.

	Specific Conductivity (milliSiemens/cm.)		Specific Resistance (Ohm-cm.)	
Test Frequency	10Hz	10kHz	10Hz	10kHz
Biomedical* Innovations CEL-071	7.8	100	128	10.0
Pharmaceutical Innovations Lectron II	.9	21	1060	47
Parker Spectra 360	.92	2.3	1090	430
Parker Tensive Gel	1.36	8.0	740	125
Tap Water (Seal Beach, CA)	.15	1.4	6500	710