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F-Thermal Therapy

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Comparative study of the effect of three different forms of cryotherapy (cryo gel bag, cold air stream or cold nitrogen) on skin temperature and skin blood flow in healthy test persons

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Following a 30-minute acclimatization period, the extensor side of the right wrist was cooled in 15 test persons aged between 20-35 years. Application time: cryo gel bag (ca. -25℃) 20 min, cold air stream (-30℃) 5 min, cold nitrogen (ca. -130℃) 5 min. Skin temperature and skin blood flow of the wrist were recorded continuously during a period from 20 min to 60 min after the respective cryotherapy. Test subjects were tested at identical times of the day and at a room temperature of 23.5℃. The median values of the test series are as follows: skin temperature was decreased by 1.5 (49% of the initial value) using cryo gel bag application, by 14.9℃ (45%) using cold air stream, and by 13.3℃ (41%) using cold nitrogen. Re warming by 50% of the decreased value of the initial temperature (= t50) took 10 min longer after cryo gel bag application than after cold air stream application (6 min) or cold nitrogen (5 min). t90 cryo gel bag: 33 min, t90 cold nitrogen: 20 min. All three forms of cryotherapy equally decreased the laser Doppler signal of the skin blood flow by approx. 40% of the initial value.
After each individual form of cold therapy, reduction of the skin blood flow lasted significantly longer than reduction of the skin temperature (laser Doppler measurement results: t90 cryo gel bag: 45 min, t90 cold air stream: 55 min, t90 cold nitrogen: 38 min). The strongest cold erythema was observed after cryo gel bag application whereas the weakest was found after cold nitrogen application. The test subjects described cold nitrogen application as the most comfortable of all three treatments while cryo gel bag application was felt as the most uncomfortable.

An important evidence for the effect of cold applications is the rewarming period after termination of the cold application as well as the duration of reduced blood flow.

In the study (2) "Comparative study of the effect of three different forms of cryotherapy on skin temperature and skin blood flow in healthy test persons" the following can be read:

"*All three forms of cryotherapy decreased the laser Doppler signal of the skin blood flow by approx. 40% of the initial value"*. According to the study, skin blood flow remained decreased for the following periods:

cold air stream	-	55 minutes
cryo gel	-	45 minutes
nitrogen	-	38 minutes

Concerning handling and economic efficiency, the following has to be remarked:

Ice bags, ice 'lollies', ice compresses:

Besides the investment costs for purchasing a freezer, running costs for electric current incur. Costs for the personnel required for applying the cold agents have to be taken into account. In addition, there is considerable downtime caused by occupied therapy rooms due to long therapy times.

Cold Packs:

Besides the investment for purchasing of freezers, only the costs for the ice packs incur. A considerable amount required for replacing lost or stolen cold agents should also be allowed for. In addition to the personnel required for preparing the treatment, labor time for cleaning, sorting and disinfection has also to be taken into account. Occupancy time of therapy rooms is similar to that for ice treatment.

Nitrogen:
Besides the investment costs for purchasing instruments and storage containers (approx. € 4,500 – 7,500) there are considerably high running costs for the purchase of liquid nitrogen. In addition to the costs per liter, often also high delivery charges have to be paid. When using nitrogen, specific safety regulations governing the handling of deep cold gases have to be observed which may also involve reconstruction of the therapy facility.

Cold air stream:

The investment costs for the cold air instrument are a little higher (€ 5,000 – 7,500) than those for nitrogen devices. Cold air devices, however, cause almost no running costs and are continuously ready for operation. There is hardly any servicing required. Except for a 220 V power supply, no additional requirements are needed for the installation site.
In the case of the CRIOJET AIR "C300" cold air system, the power consumption amounted to € 0.43 per therapy day with an average of 40 applications per day and the device being in continuous stand-by mode during working time.

References:
(1) P. Kröling, R. Schöps, M. Mühlbauer, E. Senn
Institute for Medical Balneology and Climatology, Ludwig Maximilian University Munich, Germany – Zeitschrift für physikalische Medizin – Demeter Verlag, October 1990

(2) B. C. Knollmann, M. Berliner
Clinic for Physical Medicine, Balneology and Rheumatology of the Justus Liebig University Giessen, Germany (head: Prof. K. I. Schmidt, MD)
Zeitschrift für Physikalische Medizin – Demeter Verlag, October 1990

Author's list of the measurement results – study Bad Nauheim, Dr. Berliner

	Cryo gel	Cold air stream	Nitrogen
Temperature reduction	- 49%	- 45%	- 41%
t warming > 50%	10 min	6 min	5 min
Blood flow reduction	- 45 min	-55 min	-38 min
Erythema	++	+	+
Acceptance	-	+	++