

Cold Therapy in Maxillofacial Surgery

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Background: Cryotherapy (the application of ice for therapeutic purposes) is one of the most common treatment modalities used in the immediate management of acute soft tissue injury. Despite its widespread clinical use, the precise physiological responses to therapeutic cooling have not been fully elucidated, and effective evidence-based treatment protocols are yet to be established (*BMC Musculoskelet Disord* 2007;8:125).

Patients and Methods: From January 2008 to July 2008, 10 patients (4 men and 6 women) affected by dental-skeletal classes II and III were treated. Considering the biologic effects and the low temperature achieved, in this study, a cooling and compression system, at fixed temperature and adjustable for maxillofacial cutaneous tissues, called Hiloterapy system (Hiloterapy GmbH, Ludwigsburg, Germany) was used.

Results: With the use of Hiloterapy system, the swelling and pain decrease in intensity and time, allowing a quicker path to recovery of mandibular dynamics, a better comfort for patients, and an easy management of patients by medical attendants.

Conclusions: The Hiloterapy system has been proven to have a safe and effective use as a cold therapy to control postsurgery course.

Key Words: Cold therapy, maxillofacial surgery

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Cryotherapy (the application of ice for therapeutic purposes) is one of the most common treatment modalities used in the immediate management of acute soft tissue injury. Despite its widespread clinical use, the precise physiological responses to therapeutic cooling have not been fully elucidated, and effective evidence-based treatment protocols are yet to be established.¹ The several physiological responses to therapeutic cooling are as follows: decrease of muscular spasticity, pain reduction, cell metabolism decrement, and immediate local vasoconstriction.² The most used cooling system is the application of ice in the treated area. The low temperature achieved (0°C) and the continuous changes resulting from heating of the ice packs decrease therapeutic effects.^{1,3–6} In this study, a cooling and compression system, at fixed temperature and

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adjustable for maxillofacial cutaneous tissues, applied to 10 patients between January 2008 and July 2008 was used.

The surgical treatment used was skeletal bases replacement by Le Fort I osteotomy of the maxillary bone and bilateral sagittal osteotomy of the mandible.

PATIENTS AND METHODS

From January 2008 to July 2008, 10 patients (4 men and 6 women) affected by dental-skeletal classes II and III were included in this study. The surgery performed was the skeletal bases replacement by Le Fort I osteotomy and bilateral sagittal osteotomy, respectively, of the upper and lower jaws. Two patients required a genioplasty and a rhinoplasty treatment; 2 patients required only a rhinoplasty to complete the surgery. Postsurgical edema is commonly managed by the application of ice on the treated area just after extubation of the patient, and this is continued for 24 to 36 hours. The Association of Chartered Physiotherapists in Sports Medicine recently published (1999) guidelines on the application of PRICE (protection, rest, ice, compression, and elevation) for soft tissue injuries, which provide the following recommendations:

1. The most effective duration of application is 20 to 30 minutes, with a maximum safe period of 30 minutes.
2. A damp towel should be placed between the cooling agent and the skin.
3. Care should be taken with the application of ice (or cooling agent) on areas with little subcutaneous fat or muscle, and in the region of superficial nerves, with a maximum cooling period of 10 minutes.

Considering the cold biologic effects, the low temperature achieved, and the temperature range that tissues receive during the progressive heating of ice packs, in this study, a cooling and compression system, at fixed temperature and adjustable for maxillofacial cutaneous tissues, called Hiloterapy system has been used. It is an electrical device composed of a thermostatic control mobile unit and preshaped anatomic masks/caps set for the jaws (Figs. 1–5). Checking on working temperature allows to perform a gradual and progressive cooling, preventing quick and aggressive temperature ranges that can damage tissues. The temperature used for every patient was 15°C, for 24 hours after surgery. The mask application was possible in the recovery room (Fig. 6). The skeletal bases replacement by Le Fort I osteotomy and bilateral sagittal osteotomy and rhinoplasty was performed.

At the end of stay in the hospital, the patients, doctors, and medical attendants filled out a questionnaire about postsurgery problems. There were 5 valuation points; a score of 0, 1, or 2 was assigned to every valuation point. The questionnaire score was determined using an evaluation scale from 0 to 10.

The following are valuation points and corresponding scores:

1. Pain established by patient: 0 = high, 1 = endurable, 2 = low
2. Comfort application and comfort keeping established by patient: 0 = no good, 1 = good, 2 = very good
3. General mobility of treated area established by doctors: 0 = no good, 1 = good, 2 = very good



FIGURE 1. Thermostatic control.

4. Postsurgery edema established by doctors: 0 = high, 1 = moderate, 2 = low
5. Hospital treatments needed by patients during day and night established by medical attendants: 0 = a lot, 1 = few, 2 = none

RESULTS

Ten patients between January 2008 and July 2008 underwent Le Fort I osteotomy and bilateral sagittal osteotomy for upper and lower jaws. Two patients required a genioplasty and a rhinoplasty treatment; 2 patients required only a rhinoplasty to complete the surgery. With the use of the Hilotherapy system, the swelling and pain decrease in intensity and time, allowing a quicker path to recovery of mandibular dynamics, a better comfort for patients, and an easy management of patients by medical attendants. Results of the questionnaires filled out by patients, doctors, and medical attendants at the end of patients' stay in the hospital are shown in Table 1.

DISCUSSION

Cold

Biologic Effects

The heat removal techniques determine metabolic, vascular, neural, and muscular effects. According to Van't Hoff law,



FIGURE 2. Pipes connection.



FIGURE 3. Preshaped anatomic mask mobile.

cryotherapy decreases biochemical reactions in the time unit, consequently slowing down cell metabolism. The first modification in vascular system consists of surface vessel constriction, followed by a reflex systemic vasoconstriction. The vasoconstriction increases at most at 15°C. When cutaneous temperature goes down 15°C, there is a paradox vasodilatation attributable to a paralysis of vascular smooth musculature or nervous conduction block of vasoconstrictive nervous fibers. This vasodilatation is a defense mechanism, to preserve blood flow at low temperature. Low temperature slows down peripheral nerve conduction. It has been proven that a 1° reduction in temperature causes 2.4-m/s reduction in peripheral nerve conduction, and at 10°C to 15°C, the nervous conduction is abolished completely. The effect of cryotherapy on muscles is related to the application time. If temperature reduction is limited in



FIGURE 4. Mask application modality (frontal view).



FIGURE 5. Mask application modality (lateral view).

time and related to cutaneous area, there is an increase of muscular tone for α -motoneuron stimulation by cutaneous receptors. For long application time, there will be muscular tone reduction.²

Therapeutic Effects

Biologic modifications caused by cryotherapy determine anti-inflammatory action, slowing down cell metabolism and decreasing production of inflammation chemical mediators and release (serotonin, histamine, bradykinin). The anti-edema effect is related

TABLE 1. Results of the Questionnaires Filled Out by Patients, Doctors and Medical Attendants

	% Score Assigned: 0	% Score Assigned: 1	% Score Assigned: 2
Pain established by patient	10%	30%	60%
Comfort application and comfort keeping established by patient	20%	30%	50%
General mobility of treated area established by doctors	20%	20%	60%
Postsurgery edema established by doctors	10%	20%	70%
Hospital treatments needed by patients during day and night established by medical attendants	10%	30%	60%

to vasoconstriction, minimizing blood extravasation. The pain reduction is caused by inhibition of nerve endings, slowing down nerve conduction of pain impulses and reducing inflammation phenomena. Cold temperature decreases muscular tone and spasticity.²

Cryotherapy traditional methods use a temperature of 0°, which obstructs lymphatic drainage and decreases cell metabolism.² Typical temperature ranges of ice packs decrease methodical efficacy. The Hilootherapy system works with a temperature of 15°C, constantly for at least 24 hours.

CONCLUSIONS

Ten patients between January 2008 and July 2008 underwent surgery using Le Fort I osteotomy and bilateral sagittal osteotomy for upper and lower jaws. Two patients required a genioplasty and a rhinoplasty treatment; 2 patients required only a rhinoplasty to complete the surgery. Considering cold biologic and therapeutic effects,² in this study, Hilootherapy system was used, a cooling and compression system, at fixed temperature and adjustable for cutaneous tissues, to prevent postsurgery complications. Hilootherapy system was applied in the recovery room and removed after 24 hours. At the end of stay in the hospital, the patients, doctors, and medical attendants filled out a questionnaire about postsurgery problems management. The Hilootherapy system has been proven to have a safe and effective use as a cold therapy to control postsurgery course.

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FIGURE 6. A patient on the first day after surgery.