Evaluation of the Efficacy of Hilotherapy for Postoperative Edema, Ecchymosis, and Pain After Rhinoplasty

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Purpose: Edema and ecchymosis are among the most important morbidities after rhinoplasty. The aim of the present study was to investigate the effects of hilotherapy application compared with traditional ice applications after rhinoplasty in terms of periorbital edema, ecchymosis, and pain.

Patients and Methods: A total of 60 patients (35 women and 25 men) had undergone primary rhinoplasty with the same surgeon. In the postoperative period, 30 patients in the study group received continuous cooling at 15°C using Hilotherm (Hilotherm GmbH, Argenbühl-Eisenharz, Germany), and 30 patients in the control group were treated with conventional cryotherapy with ice packs. Both treatments started within 45 minutes after the end of the surgery and were maintained for 24 hours. For the following 1 week, the patients were examined for edema, ecchymosis, and pain.

Results: When the postoperative periorbital region was evaluated for mean edema and mean ecchymosis for 7 days, less edema and less ecchymosis were detected in the Hilotherm group compared with that observed in the ice pack group ($P < .001$). When the mean pain scores were compared both morning and evening for 7 days, less pain had been recorded with Hilotherm application compared with ice application ($P < .001$).

Conclusions: Hilotherapy is a useful method to prevent postoperative edema, ecchymosis, and pain compared with traditional ice application.

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Edema, ecchymosis, and hemorrhage after rhinoplasty are among the most important morbidities affecting patients' postoperative life and comfort. Osteotomy has been the most commonly responsible procedure for these morbidities. Although bone fractures are formed during the osteotomy, the angular veins in the osteotomy line will be damaged and cause bleeding in the tissue.[1,2] Several methods, such as steroids, decongestants, herbal supplements, and various lateral osteotomy techniques, have been tried for many years to reduce the postoperative edema and ecchymosis.[1,3-9] In addition, the amount of edema and ecchymosis can vary among different patients, even if they have undergone surgery with similar techniques

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and durations. After maxillofacial surgery, cryotherapy (the application of ice packs) has been commonly used to reduce pain, ecchymosis, and edema.[10] Similarly, cold applications after rhinoplasty have been frequently used. Ice application provides benefits by impairing microvascular blood circulation and lymphatic drainage in the area. However, it can also cause cold burns and patient discomfort at the applied area.

Hilotherapy (Hilotherm GmbH, Argenbühl-Eisenharz, Germany) is a water-circulating cooling device that enables continuous cooling at a certain temperature via a face mask (Fig 1). The temperature of the water in the mask is fixed at 15°C. Thus, the device provides the desired effects of cold application, without causing unwanted effects such as cold injury. Therefore, patient discomfort does not occur, and the maximum benefit can be obtained from the cold application.[11-15] Some studies have reported on the use of Hilotherm after various maxillofacial surgeries; however, to the best of our knowledge, no study has yet reported on its use after rhinoplasty.

In the present study, we investigated the effects of Hilotherm application after rhinoplasty in terms of periorbital edema, ecchymosis, and pain and compare its effects with those from traditional ice applications.

Patients and Methods

Sixty patients (35 women and 25 men, mean age, 26 ± 5.2 years) who had a nasal deformity and had undergone primary rhinoplasty from August 2018 to March 2019 at the Okmeydani Training and Research Hospital were enrolled in the present prospective randomized trial. All included patients provided written informed consent. The study was approved by the local ethics committee at Marmara University Faculty of Medicine (approval no. 09.2018.555). All 60 patients had undergone an open technique septorhinoplasty with external lateral osteotomy by the same surgeon. In the postoperative period, the patients were randomly divided into 2 groups: the 30 patients in the study group received continuous cooling at 15°C using the Hilotherm (group A), and the 30 patients in the control group were treated with conventional cryotherapy with ice packs (group B). All the patients received the same medical treatment postoperatively. The Hilotherm and conventional cryotherapy treatments both started within 45 minutes after the end of the surgery and were maintained for 24 hours. The patients in the control group applied ice for 45 minutes and rested for 15 minutes each hour to avoid ice burns (Fig 2). The patients were discharged on the second postoperative day. After the patients had been discharged, they took their photographs once a day for 4 days and sent them to us. The patients were evaluated in the hospital for the first 2 days and by the photographs for the next 4 days for periorbital edema and ecchymosis by an observer, who did not know which procedure had been administered to each patient. The periorbital regions of the patients were divided into 4 regions (right upper eyelid, right lower eyelid, left upper eyelid, left

FIGURE 1. Hilotherapy device.

Hanci et al. Hilotherapy in Rhinoplasty. J Oral Maxillofac Surg 2020.

FIGURE 2. Ice application.

Hanci et al. Hilotherapy in Rhinoplasty. J Oral Maxillofac Surg 2020.

lower eyelid), and each region was divided into 4 sections from medial (section 1) to lateral (section 4) sides (Fig 3). The periorbital region was scored according to which section, from 1 to 4, the edema and ecchymosis had spread. For pain, the patients evaluated themselves using a visual analog scale twice each day, morning and evening, for 7 days. The thermal splints were removed at 7 postoperative days, and the patients underwent their final evaluations for ecchymosis and edema.

STATISTICAL ANALYSIS

SPSS, version 23.0 (IBM Corp, Armonk, NY) was used for statistical analysis. The suitability of the measured variables to a normal distribution was examined using Kolmogorov-Smirnov and Shapiro-Wilk tests. The parameters with a normal distribution were evaluated using an independent samples *t* test.

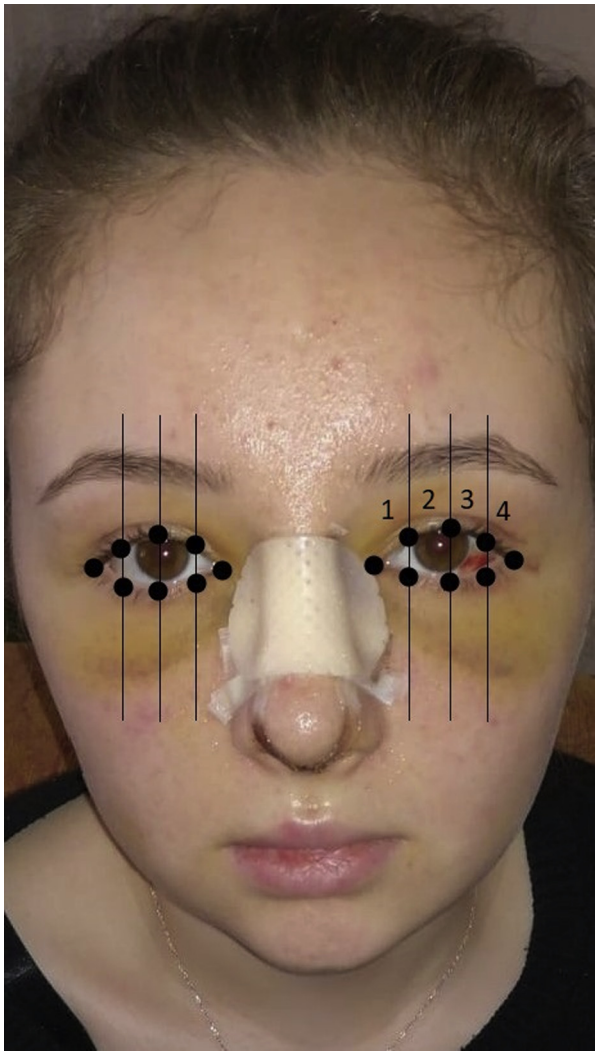

FIGURE 3. Periorbital sections.

Hanci et al. Hilotherapy in Rhinoplasty. J Oral Maxillofac Surg 2020.

The parameters that did not fit the normal distribution were evaluated using the Mann-Whitney *U* test. $P < .005$ was considered to indicate statistical significance.

Results

When the postoperative periorbital region was evaluated for the mean amount of edema for 7 days, less edema was detected in all 4 regions after Hilotherm application compared with that after ice application ($P < .001$; Table 1). When the postoperative periorbital region was evaluated for the mean amount of ecchymosis for 7 days, less ecchymosis was detected in all 4 regions after Hilotherm application compared with that after ice application ($P < .001$; Table 1). When the mean pain scores were compared in both the morning and the evening for 7 days, the patients in the Hilotherm group had recorded less pain compared with the patients in the ice application group, and the difference was statistically significant ($P < .001$; Table 2).

Discussion

Rhinoplasty is one of the most common facial plastic surgical procedures. Postoperative edema and ecchymosis are common after facial surgical procedures. After rhinoplasty, ecchymosis and edema have been the most important morbidities affecting patients' satisfaction. Many methods have been used to prevent the development of ecchymosis and edema. Corticosteroids have been used to reduce postoperative edema and ecchymosis, and successful results have been achieved.[1,6,16] Totonchi and Guyuron[2] investigated the effect of arnica and corticosteroid use on edema and ecchymosis. They found that arnica was superior to the corticosteroid and control groups in terms of edema on the second postoperative day. In contrast, they reported that the use of corticosteroids resulted in worse outcomes compared with the control group in terms of ecchymosis on postoperative day 8. Chaiet and Marcus[3] investigated the effects of arnica on postoperative ecchymosis and found that it improved patient satisfaction, with quicker resolution of postoperative ecchymosis. Hashemi et al[5] compared the effects of internal and external lateral osteotomy on edema and ecchymosis and found that both ecchymosis and edema were less after external osteotomy than after internal osteotomy. Yücel[8] also compared internal and external lateral osteotomies in terms of edema and ecchymosis. On the second postoperative day, he found that ecchymosis was less after internal osteotomy but that the 2 groups were identical in terms of ecchymosis and edema.[8] Taş[17] applied postoperative vibration treatment to rhinoplasty patients

Table 1. COMPARISON OF HILOTHERM AND ICE APPLICATION IN TERMS OF EDEMA AND ECCHYMOSIS

	Hilotherm			Ice Application			
Variable	Median	Minimum	Maximum	Median	Minimum	Maximum	*P* Value
Right upper eyelid							
Mean edema	1.14	1.00	1.14	2.29	1.57	2.43	≤.001*
Mean ecchymosis	1.07	0.71	1.43	2.86	2.43	3.14	≤.001*
Right lower eyelid							
Mean edema	1.29	1.29	1.29	2.29	1.71	2.29	≤.001*
Mean ecchymosis	1.29	1.00	1.57	2.57	2.29	2.71	≤.001*
Left upper eyelid							
Mean edema	1.25	1.00	1.50	2.38	1.75	2.63	≤.001*
Mean ecchymosis	1.00	0.71	1.43	2.86	2.43	3.14	≤.001*
Left lower eyelid							
Mean edema	1.14	1.00	1.14	2.00	1.57	2.00	≤.001*
Mean ecchymosis	1.29	1.14	1.71	2.86	2.43	3.00	≤.001*

* Statistically significant.

Hanci et al. Hilotherapy in Rhinoplasty. J Oral Maxillofac Surg 2020.

and reported that it significantly reduced postoperative ecchymosis and edema.

Cold compresses after injuries or operations have been widely used for many years to reduce pain and swelling. Cold applications after maxillofacial surgery have been widely used to reduce ecchymosis and edema.[10] Cold is believed to reduce pain and swelling. Cold application acts by local vasoconstriction after rhinoplasty. However, cold also slows down the cell mechanism, reduces the production of inflammatory chemical mediators such as bradykinin, histamine, and serotonin, and reduces muscular tone and spasticity.[18]

Table 2. COMPARISON OF HILOTHERM AND ICE APPLICATION IN TERMS OF PAIN (VAS SCORE)

	VAS Score	
Variable	Morning	Evening
Hilotherm		
Mean	0.60	0.35
Median	0.57	0.36
Minimum	0.57	0.14
Maximum	0.71	0.71
P value	<.001*	<.001*
Ice application		
Mean ± SD	1.14 ± 0.09	0.91 ± 0.17
Median	1.14	1.00
Minimum	1.00	0.71
Maximum	1.29	1.14
P value	<.001*	<.001*

Abbreviations: SD, standard deviation; VAS, visual analog scale.

* Statistically significant.

Hanci et al. Hilotherapy in Rhinoplasty. J Oral Maxillofac Surg 2020.

In conclusion, vasoconstriction reaches its highest level at 15°C, because of the blockade of α-adrenergic vascular innervation.[19] The analgesic effect of cold treatment is thought to result from a decrease in the rate of conduction velocity of nerve impulses through the C-fibers.[20,21] At temperatures less than 15°C, nerve conduction is prevented, and vasodilatation occurs instead of vasoconstriction.[22] Hilotherapy is an alternative method to classic cold application. It is a water-circulating cooling device that provides continuous cooling through a face mask. Conventional cooling methods such as ice application provide a temperature of 0°C, which prevents lymphatic drainage and slows down cell metabolism.[23] In addition to the cooling effect, ice itself can also cause pain. Hilotherapy avoids the occurrence of cold-induced pain and enables a more physiologic cooling, at a temperature of ~15°C. In addition, hilotherapy improves patient compliance by avoiding the need for continuous refreshing of the ice, as described in previous studies.[11-13,15] Chadha et al[24] found that postoperative administration of hilotherapy to patients undergoing orthognathic surgery reduced the need for analgesia. Lateef et al[22] found that Hilotherm administration significantly reduced postoperative pain and edema in maxillofacial traumatized patients and after orthognathic surgery. Modabber et al[14] compared Hilotherm and conventional ice application in zygomatic bone fractures and found that the postoperative pain and swelling were less after Hilotherm administration. Beech et al[25] evaluated the use of Hilotherm after surgical removal of mandibular third molars using a quality of life questionnaire. They

reported that patients' quality of life was significantly improved and patients returned to normal life within a shorter period. In our study, we found that postoperative pain, edema, and ecchymosis were significantly less for the patients using Hilotherm than for those using conventional cryotherapy, similar to the findings from previous studies.

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