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Reconstructive

Hypnosis Influence on the Perfusion in Perforator Flaps in Early Postoperative Period: A Series of 18 Cases

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Introduction: In practice worldwide, there are experiences affecting different body functions via central control mechanisms with the help of psychotherapy methods. In plastic and reconstructive surgery, there is the experience of applying hypnosis, with the main goal of eliminating pain. The aim of this research is to study the impact of hypnosis on the perfusion level in perforator flaps in the early postoperative period, which could enhance flap survival.

Patients and Methods: For studying the impact of hypnosis on blood circulation in perforator flaps, the analysis of a 18 cases has been conducted. All patients had hypnosis sessions on the second day after the reconstruction, and some had additional sessions on the third and fifth days. In the state of trance, the patient was given specially organized instructions aimed at improvement of perforator flap perfusion. Monitoring of microcirculation in the flap during hypnosis sessions was carried out using a Moor VMS-LDF1 Laser Doppler Perfusion and Temperature Monitor.

Results: When applying hypnosis, the vast majority of patients had significant increases in perfusion as well as flap surface temperature rise. Most of the patients had significant increases in perfusion during the second part of the hypnosis session in synchrony with hypnosis instruction translation aimed at increasing perfusion.

Conclusions: The results of our research cannot be distributed widely in medical practice, but, despite that, they illustrate the central nervous system influence on perforator flap perfusion. Including hypnosis in a medical protocol can contribute to increasing the effectiveness of flap surgery. *(Plast Reconstr Surg Glob Open 2019;7:e2491; doi: 10.1097/GOX.0000000000002491; Published online 25 November 2019.)*

INTRODUCTION

The perforator flap can be considered the latest advance in the continuing evolution of flap choices for reconstructive purposes. These flaps provide excellent esthetic results. On the other hand, this method is accompanied by complications in the form of tissue perfusion disorders. Vasospasm and thrombosis as a result of surgical trauma and perfusion failure in distal areas of the flap are the main reasons for flap loss.[1] However, there is little critical information about the pathogenesis of the disorders described.[2] At the same time, reviews on the role of vasoactive neurohumoral substances in local vascular tone regulation in normal and altered states have been published.[3–5] These articles can give an idea of the pathogenesis of vasospasm and thrombosis in reconstructive surgery. The regulation of local blood circulation in tissues is based on nervous, humoral, physical, and metabolic impacts. Trauma to sympathetic nerve endings leads to the release of noradrenaline, which triggers vasospasm and platelet aggregation.[6] Thus, sympathetic nerves and vascular endothelium trauma can cause vasospasm and intravascular platelet aggregation, especially in minor arteries in the distal area of the flap where the perfusion pressure is low.

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Perforator flap plastic surgery failures remain a problem all over the world, and an increasing number of specialists are trying to solve it. They propose numerous variants for surgical treatment optimization, soft-tissue trauma reduction, and postoperative flap monitoring. Preoperative planning variants with precision perforator location and postoperative optimal perfusion medical support are being developed.[7–10]

In practice worldwide, there are experiences affecting different body functions via central control mechanisms with the help of psychotherapy methods.[11] In plastic and reconstructive surgery, there is the experience of applying hypnosis, with the main goal of eliminating pain.[12,13] The use of hypnosis in reconstructive surgery as a primary or auxiliary anesthetic during the perioperative period or during surgery has been assessed.[14,15] At the same time, there are publications showing a great influence of the mind and emotions on the outcomes of surgical operations.[16]

Our study is focused on the influence of hypnosis on perfusion in perforator flaps for evaluation of the probable use of this method in complex postoperative treatment.

The aim of this research is to study the impact of hypnosis on the perfusion level in perforator flaps in the early postoperative period, which could enhance flap survival.

PATIENTS AND METHODS

For studying the impact of hypnosis on blood circulation in perforator flaps, the analysis of a series of cases has been conducted. A total of 18 patients underwent reconstructive surgery from 2016 to 2018 in the Burn and Plastic Surgery Centre, Dnipro, Ukraine, and gave their informed consent to participate in the medical research given. The common demographic information about the participants was collected. No confidential personal data were used, and bioethics were observed.

Inclusion criteria were as follows: adult men and women 18–65 years of age with deep wound defects and exposure of deep anatomical structures that require closure with flaps; wound defects after removal of necrosis or pathologic tissues; reconstruction with Keystone, propeller, and pedicle perforator flaps; and only cases of noncomplicated flaps. Exclusion criteria included medical comorbidities such as diabetes mellitus, HIV/AIDS, systemic connective tissue diseases, cardiovascular diseases, and patients having undergone previous radiation therapy to the reconstructive area.

The age of the patients who participated in the study varied from 20 to 65 years of age, averaging 40.4 years of age (14.9) . Out of 18 participants, the vast majority (15%–83%) were male (Table 1).

The patients with no manifestations of infectious inflammation of the wound process and no associated temperature reactions were included in the group studied.

All the patients had identical basic anesthesia and did not have severe pain syndromes at the time of hypnosis session.

Table 1. Patient Demographic Data

Data	n (%)
Sex: male	15 (83)
Female	3 (17)
Flap: propeller	8 (44)
Pedicle	7 (39)
Keystone	3 (17)
Localization: foot	6 (33)
Hand	1 (5.5)
Groin	1 (5.5)
Thigh	3 (17)
Forearm	2 (11)
Lower leg	2 (11)
Trunk	3 (17)
Etiology: burn	1 (5.5)
Electric burn	3 (17)
Oncology	1 (5.5)
Scars	4 (22)
Traumatic wound	7 (39)
Trophic wound	2 (11)

Hypnosis Description

All patients had hypnosis sessions on the second day after the reconstruction, and some had additional sessions on the third and fifth days. Hypnosis sessions were conducted by a certified psychotherapist.

The patient was put in a trance with the help of hypnotherapy methods. In that state, the patient was given specially organized instructions aimed at improvement of perforator flap perfusion. Patients were put in a trance by means of verbal and nonverbal induction. By hypnotherapy methods is meant a standard procedure for targeting the trance state. The nonverbal part of the guidance included the use of voice intonations in the Erickson approach. By specially organized instructions is meant the use of direct hypnotic commands aimed at improving the blood supply of the flap. Each hypnotic session consisted of 2 stages: (1) creating a deep trance state and (2) broadcast procedural trance instructions aimed at achieving the stated effects.

The hypnosis sessions lasted 50–60 minutes on average. The research was conducted during the daytime in the morning between breakfast and lunch in the recumbent position at a constant room temperature (within 19°C–21°C). In all cases, the hypnosis sessions were done with a background of basic analgesia: nonsteroidal anti-inflammatory drugs (ketorolac) or centrally acting analgesic (analgin). Patients with reconstruction of lower extremity defects had basic prolonged epidural anesthesia as a local anesthetic for 5 days on average.

Perfusion Measurement

Monitoring of microcirculation in the flap was carried out using a Moor VMS-LDF1 Laser Doppler Perfusion and Temperature Monitor (Moor Instruments Inc., Axminster, United Kingdom) with a combined optical probe VP1T. Moor VMS recording and analysis software were used to measure tissue blood flow (perfusion units) and skin temperature (°C) and to determine the concentration (number) of moving blood cells in the tissue sample volume (arbitrary units) and backscattered laser light intensity (arbitrary units), indicating the confidence level.

The measurements were carried out 4 times: first time—before the hypnosis session; second time—trance formation and deepening; third time—in a deep trance and at the time of intense hypnosis instructions aimed at increasing perfusion; and fourth time—after the hypnosis

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Table 2. Characteristics of Cases

Patient	Age	Sex	Flap	Localization	Etiology	Sessions
1	33	M	ALT pedicle flap	Trunk	Burn	1
2	26	M	DPAU flap	Hand	Electric burn	1
3	61	M	Propeller	Foot	Traumatic wound	1
4	23	M	MSAP flap	Foot	Traumatic wound	3
5	60	F	MSAP flap	Foot	Trophic wound	2
6	65	M	ALT pedicle flap	Groin	Scars	1
7	40	M	PFAP-3 flap	Thigh	Scars	2
8	57	M	ARP flap	Hand	Scars	1
9	50	M	Keystone	Thigh	Electric burn	2
10	47	F	Propeller	Forearm	Traumatic wound	1
11	26	M	MSAP flap	Foot	Traumatic wound	1
12	26	M	Propeller	Lower leg	Traumatic wound	1
13	39	M	Propeller	Lower leg	Traumatic wound	1
14	35	M	LAP flap	Trunk	Oncology	1
15	20	M	SAIP	Trunk	Scars	1
16	44	F	Keystone	Foot	Traumatic wound	1
17	41	M	MSAP flap	Foot	Trophic wound	1
18	35	M	Keystone	Thigh	Electric burn	1

ALT, anterolateral thigh; ARP, artery radialis perforator; DPAU, distal perforator artery ulnar; F, female; LAP, lumbar artery perforator; M, male; MSAP, medial sural artery perforator; PFAP-3, third perforator of the profunda femoris artery flap; SAIP, supraclavicular artery island flap.

Table 3. Results of Flap Perfusion Measurement before, during, and after Hypnosis

Parameter	1 Measurement	2 Measurement	3 Measurement	4 Measurement	$P_{(1–2)}$	$P_{(1–3)}$	$P_{(1–4)}$
Perfusion (PU), mean (SD)	22.7 (12.9)	24.1 (13.2)	25.7 (14.9)	25.7 (15.1)	0.004	0.025	0.019
Temperature (°C), mean (SD)	29.9 (2.2)	31.1 (2.0)	31.8 (2.1)	32.0 (2.2)	<0.001	<0.001	<0.001
Blood cell concentration (AU), median (25%; 75%)	74.4 (56.8; 101.1)	71.9 (55.9; 105.6)	73.9 (57.1; 113.0)	77.5 (55.1; 111.7)	0.446*	0.420*	0.523*
Level of confidence, mean (SD)	66.4 (23.4)	65.8 (20.6)	65.6 (19.4)	60.9 (24.3)	0.696	0.739	0.377

P values were determined by the dependent samples *t* test.
**P* values were determined by the Wilcoxon matched pairs test.
AU, arbitrary unit; PU, perfusion unit.

session. In addition to average perfusion data and perforator flap temperature, the difference between current and initial data before hypnosis was evaluated.

Statistical Analysis

The descriptive and analytical statistics for data analysis have been used. The statistical tests to be applied were chosen depending on the results of the preliminary Shapiro–Wilk *W* tests for normality.

The data were expressed as the mean (SD) and coefficient of variation (%) for normally distributed data.

The median and interquartile range (75th and 25th percentiles)—median (25%; 75%)—for nonnormally distributed data were used.

A *t* test for dependent samples or Wilcoxon matched pairs test was used for repeated measures designs for normally/nonnormally distributed data, respectively.

Ninety-five percent confidential intervals (95% CIs) were used to compare results between groups. Differences in the estimates were considered to be significant when the 95% 0043I did not include zero.

Spearman correlation analysis (r s - Spearman rank order correlations) was used to measure the strength of association between variables.

All analyses used a two-sided significance level of 5%.[17]

Statistical analysis was conducted using Microsoft Excel (Redmond, Washington, Office Home Business; 2KB4Y-6H9DB-BM47K-749PV-PG3KT) and STATISTICA 6.1 software (Palo Alto, California, StatSoftInc.; serial No: AGAR909E415822FA).

RESULTS

The time of the hypnotic trance phase ranged from 9 to 43 minutes and averaged 17.1 minutes (11.4; 26.2 minutes). Different durations of sessions were associated with different rates at which patients entered into a state of deep trance. The faster they entered it, the shorter the session time. If the first stage of the session was too short, it worsened the final result.

The size of the flap varied in the range from 4 × 4 cm to 16 × 29 cm and averaged 9.1 (3.4) × 13.3 (8.3) cm. With regard to the defect localization, the foot prevailed with 7 cases (39%), whereas traumatic injuries prevailed with 7 cases (39%) with regard to etiology (Table 2).

The results of the measurement of the hypnosis dynamics remained almost unchanged before, during, and after hypnosis for the level of confidence and concentration of moving blood cells in the tissue sample volume (Table 3).

When applying hypnosis, the vast majority of patients had significant increases in perfusion and flap surface temperature rise (Fig. 1).

Most of the patients had significant increases in perfusion during the second part of the hypnosis session in synchrony with hypnosis instruction translation aimed at increasing perfusion, whereas a temperature increase was observed earlier in the first half of the hypnosis session (Fig. 2).

The surface temperature of the flap increased progressively, rising an average of 1.2° (95% CI, 0.8°–1.7°) during trance formation and deepening to 2.1° (95% CI, 1.4°–2.9°) of final difference between measurements before and after the hypnosis session (Table 4).

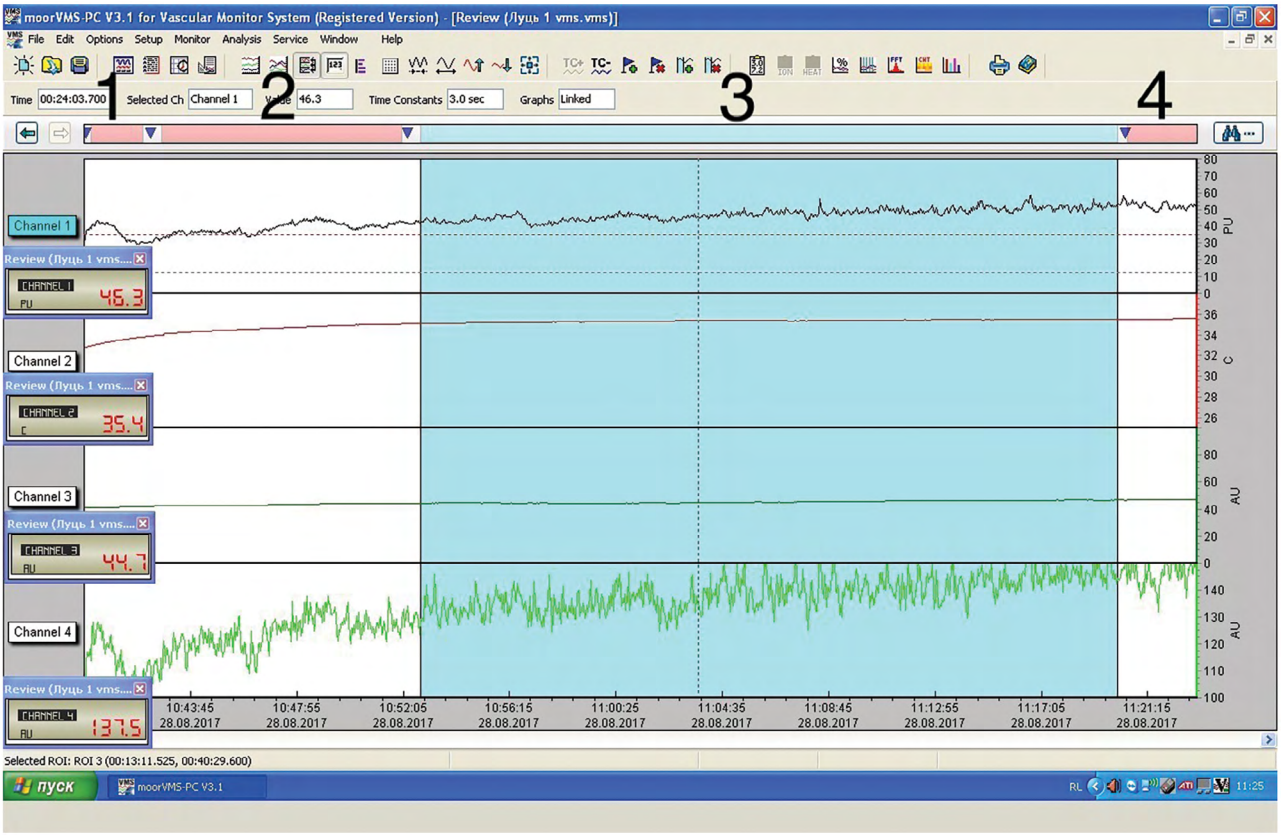

Fig. 1. Flap monitoring. Changes of perfusion in the flap in different stages of hypnosis. 1: before the hypnosis session; 2: trance formation and deepening; 3: in a deep trance and at the time of intense hypnosis instructions aimed at increasing perfusion; and 4: after the hypnosis session.

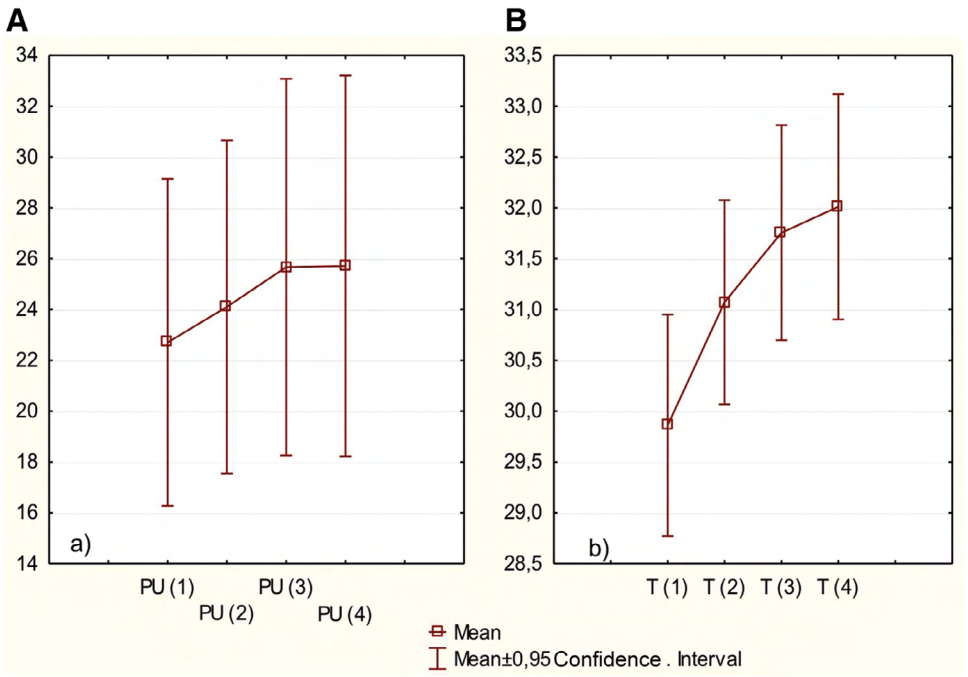

Fig. 2. Average flap perfusion (A) and surface temperature (B) under hypnosis within 4 dynamic measurements. PU, perfusion unit.

Table 4. Changes in Flap Perfusion and Surface Temperature under Hypnosis between First Measurement before the Hypnosis Session and the following Measurements in Dynamics (during and after Hypnosis Session)

Changes in Parameters	Minimum	Maximum	Mean	CI −95.0%	CI +95.0%	Coef. Var., %
Flap perfusion changes (PU)						
2 measurement – 1 measurement	−1.9	4.0	1.4	0.5	2.3	128.9
3 measurement – 1 measurement	−4.0	13.5	3.0	0.4	5.5	172.5
4 measurement – 1 measurement	−4.0	16.2	3.0	0.6	5.5	163.2
Flap surface temperature changes (°C)						
2 measurement – 1 measurement	0.0	2.5	1.2	0.8	1.7	74.4
3 measurement – 1 measurement	0.0	4.6	1.9	1.3	2.5	68.4
4 measurement – 1 measurement	0.2	5.6	2.1	1.4	2.9	69.3

Coef. Var., coefficient of variation; PU, perfusion unit.

Flap surface temperature variability was high but was lower than flap perfusion variability, which varied significantly in different patients from decreasing to significantly increasing. Therefore, the average flap perfusion after the hypnosis session in patients who participated in the research increased by 3.0 units (95% CI, 0.6–5.5 units). The highest growth rate in flap perfusion was between the first measurement before the hypnosis session and the third measurement in a deep trance—3.0 units (0.4–5.5 units). This average for flap perfusion remained, even after the hypnosis session.

DISCUSSION

In recent years, more and more publications have reported the influence of the central nervous system (CNS) on processes in the body, including the processes of healing and recovery after surgery.[16,18]

The mind–body connection is receiving increasing scrutiny in a large number of clinical settings. Psychoneuroimmunology is a novel interdisciplinary scientific field that examines the relationship of the mind to the patient's neurologic, endocrine, and immune systems by examining critical parameters, such as the effects of mental stress on wound healing and infection rates. Techniques that modify a patient's emotional and mental responses to illness and surgery have positive effects on their physiology, resulting in improved recoveries and higher patient satisfaction rates.[16,19,20]

Today, this field is poorly developed in reconstructive plastic surgery.[21]

Our preliminary study showed the possibility of influence (through the CNS) on the level of microcirculation in perforator flaps.

Statistically significant increases in perfusion indicate the effectiveness of hypnosis, averaging an increase of 3 units (95% CI, 0.6–5.5 units) and 2.1° (95% CI, 1.4°–2.9°) of final difference between measurements before and after the hypnosis session. Therefore, we can assume that including hypnosis in the medical postoperative protocol will allow for increases in the effectiveness of flap surgery.

Therefore, the significant variation in changes of the parameters shows equivocal results for different patients, and it requires further research.

The influence of hypnosis on perfusion could not be considered conclusively proven because the number of cases observed should be increased and the outline of the study should be expanded. However, for now, it may be said that there is a tendency for a hypnosis positive impact on perfusion parameters in the flap after reconstructive surgery. In the estimation of factors influencing the process studied, there is the only statistically significant correlation coefficient between the flap size and the flap surface temperature increase: $rs = -0.65$ ($P = 0.020$). The larger the flap is, the less the surface temperature of the flap increases under hypnosis. However, the same tendency is observed in the case of basic and additional therapies. According to the obtained research data, it could not be concluded that there is a stable prolonged positive effect after hypnosis. In this way, the hypnosis sessions should be conducted regularly or should be replaced with relevant medicines. For future analysis, it is advisable to monitor the anxiety level of the patient at the time of the hypnosis sessions because the research results in reconstructive surgery show significant anxiety levels in the preoperative period[12] and in the postoperative period.

Our study is preliminary. In the future, to obtain more evidentiary results, it is necessary to increase the number of studied patients and connect with other research centers to collect more homogeneous groups according to the type of flaps and localization; however, today we can talk about the possibility of improving the microcirculation in the flaps and increasing their survival through the influence of hypnosis.

CONCLUSIONS

The results of our research cannot be distributed widely in medical practice; nonetheless, they illustrate the influence of the CNS on perforator flap perfusion. Including hypnosis in a medical protocol can contribute to increasing the effectiveness of flap surgery.

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