

The Effects of Different Intervals of Microdermabrasion Sessions on Skin Biophysical Parameters: A Randomized, Assessor-Blind, Within-Patient Trial

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Abstract

Background: Microdermabrasion has recently become a popular procedure among physicians and patients, whereas few studies have assessed the efficacy of different microdermabrasion protocols nowadays applied. The objective of this study was to assess the effects of microdermabrasion, as well as to compare the effects of weekly and biweekly intervals of microdermabrasion sessions on skin biophysical parameters.

Methods: Ten patients entered this randomized, investigator-blind, split face study and underwent a series of six microdermabrasion treatments. One side of the face was treated every week and the other side was treated every 2 weeks, randomly. Stratum corneum hydration, sebum secretion and skin pH measurements were taken before and after the procedure on all sessions and also 1 and 4 weeks after the last treatment.

Results: After 6 sessions of microdermabrasion and following comparison to baseline, a significant decrease in sebum content and a significant increase in skin pH were observed only on the side treated with the intervals of 2 weeks. Changes in skin hydration were not significant on either side.

Conclusion: Microdermabrasion may have noticeable effects on skin barrier functions. It is recommended to have 2 week interval between sessions. (*Iran J Dermatol* 2008;11:49-54)

Keywords: microdermabrasion, randomized controlled trial, sebum, hydration

Introduction

Over the past few years, there has been a worldwide growth in the use of microdermabrasion (MDA) for skin resurfacing and management of several skin conditions such as fine rhytides, actinic damage, mottled pigmentation, clogged pores, acne, acne scars and stretch marks.¹⁻⁶ MDA appears to be of benefit due to its effectiveness, minimal discomfort, few complications, no need for anesthesia, no bleeding or visible desquamation and prompt recovery.

This newly introduced technique abrades the skin and causes superficial trauma to stratum corneum layers using a high-pressure flow of inert crystals and negative pressure for aspirating the mentioned crystals and epidermal cellular debris.

It is suggested that MDA-induced injury amplifies dermal remodeling cascade^{7,8} and stimulates

fibroblast proliferation and new collagen deposition in the dermis. Thus, it leads to gradual improvement in the appearance of damaged skin.^{9,10} In addition, water content and skin barrier alterations, following MDA, seem to be responsible for the observed clinical improvement.¹¹

Since a single session of MDA does not produce satisfactory clinical outcomes, it is often administered weekly or biweekly in multiple sessions.¹² The purpose of this study was to compare the effect of different intervals of MDA sessions on the biophysical properties of skin.

Patients & Methods

Participants

This study was approved by the ethics committee of Center for Research and Training in Skin Diseases and Leprosy. Ten volunteers older than 18 years were included in this assessor-blind,

randomized clinical trial. Exclusion criteria were use of oral retinoids within 1 year or use of topical retinoids within 1 month prior to the study, any previous rejuvenation method (chemical peeling or MDA) within the past 6 months, active bacterial or viral skin infection, pregnancy, diabetes mellitus, or any immunosuppressed status.

Each volunteer signed a written informed consent before entering the study. Patients were advised to avoid washing their faces or applying any topical medication within 6 hours before the measurements.

Microdermabrasion procedure

All treatments were performed by a single investigator (AF) using an aluminum oxide crystal microdermabrasion unit (Silk Peel, General Project, Italy). One side of the subject's face was randomly treated every week for a total of six treatment sessions, and the other side was microabraded every 2 weeks, for a total of 6 treatment sessions. Treatment with MDA began with a vacuum pressure of 60 KPa and increased in subsequent sessions to the maximum of 70 KPa, if patients tolerated. At each treatment session and for each treatment group (each side of the face whether treated weekly or biweekly), two complete passes of MDA were performed. The eyes of the patient and the clinician were protected during the procedure by a pair of cotton pads and goggles, respectively.

Patients were instructed to decrease sun exposure and use sun screen during the study to prevent postinflammatory hyperpigmentation.

Measurements

Measurements were carried out on the right and left sides of face immediately before and 30 minutes after MDA procedure, and also one (follow up 1) and four (follow up 2) weeks after the final treatment. All measurements were performed in a single room with a temperature of 21°C and humidity of 50-60%.

Sebum content on forehead was measured by Sebumeter SM810 (Courage and Khazaka Electronic GmbH, Cologne, Germany) and expressed as micrograms of sebum per square centimeter. As an indicator of skin hydration, skin electrical capacitance was obtained on cheeks with Corneometer CM825 (Courage and Khazaka Electronic GmbH, Cologne, Germany) and expressed digitally in arbitrary units. Skin pH was measured on cheeks, using pHmeter pH900 (Courage and Khazaka Electronic GmbH, Cologne, Germany).

Patients were questioned regarding their satisfaction with skin color, elasticity, and hydration, also the improvement of fine wrinkles, mottled

pigmentation and acne scars, using a 100-point ordinal rating scale in two follow-up sessions.

During the treatment period and follow-ups, any complication related to the MDA procedure was recorded.

Randomization and blinding methods

A computer generated randomization list was prepared. Written treatment protocols, based on mentioned randomization list, were in sealed envelopes which were opened by the physician (A.F.) that performed the microdermabrasions.

All measurements were taken by a single assessor (P.D.), who was unaware of treatment interval for each side.

Statistical analysis

Kolmogorov Smirnov test showed an abnormal distribution of continuous variables; so non parametric tests were used. Some data were reported as median and interquartile range (IQR). Wilcoxon's signed rank test was used to compare the measurements before MDA with the ones after MDA, as well as to compare right and left sides.

Friedman test was used to compare each skin physiologic variable in each side during the sessions to assess whether each treatment group was effective at all or not.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL) software version 14.0. P values less than 0.05 were considered significant.

Results

Demographic characteristics

Volunteers were eight women and two men, aged 22 to 48 years (median: 28.5, IQR: 12.25 years). Five patients had Fitzpatrick skin type III and other 5 had Fitzpatrick skin type IV. The indication of MDA was fine wrinkles (3 patients), dyschromia (3 patients), comedonal acne (3 patients), and acne scar (1 patient).

Patients' satisfaction and complications

No significant difference in patients' satisfaction was observed after comparing the two treatment sides in follow-up sessions (figure 1). All patients tolerated the MDA protocols and none of them reported any considerable complications. Only two patients experienced mild erythema, which was resolved within few hours after the treatment.

Skin sebum content

A decrease in sebum content was observed 30 minutes after the procedure, which was significant in the forth to sixth sessions for the side being treated weekly and in the second to sixth sessions for the side being treated biweekly ($p < 0.05$) (figure 2).

Skin sebum content was significantly lower in the side treated biweekly than the other side after the last MDA session, but this difference was not found in follow-up visits (table 1). In addition, changes from baseline for sebum content were only significant on the side treated biweekly and only after the last session (table 2).

Skin water content

Skin hydration did not show any significant changes after MDA in any treatment session (figure 3). Also no significant differences were observed between weekly and biweekly MDA at baseline, last treatment session and follow-ups (table 1). Changes of water content from baseline were only significant on the side treated biweekly and only four weeks after the last MDA session (follow-up 2, table 2).

Skin pH

Skin pH did not show any significant changes after MDA in any session, except in session four for the side treated with the intervals of 2 weeks (p=0.02, figure 4).

There was no significant difference in pH between the two sides (table 1). Both sides showed a significant increase in pH compared to baseline (table 2).

Discussion

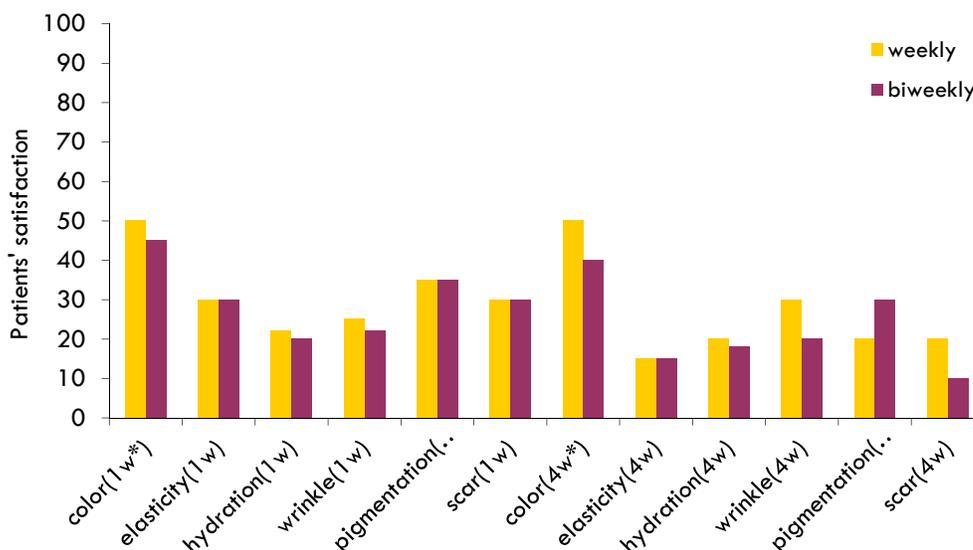
Microdermabrasion is an effective and non invasive skin resurfacing technique with perceptible

patient satisfaction^{5,13} and mild adverse effects.^{4,14}

Several studies have documented changes in skin barrier characteristics after a series of MDA treatments and also a single MDA procedure.^{2,11,15} In this study, decrease in sebum content immediately after MDA and the following increase between sessions may indicate disruption and regeneration of this barrier induced by MDA. However, Karimipour et al⁷ mentioned that MDA does not alter stratum corneum structure or trigger biochemical repair since this technique does not result in significant stratum corneum removal and induction of enzymes which are present in skin barrier disruption comparing with tape stripping.

In comparison with baseline, a significant sebum decrease after the final treatment session was observed only on the half face treated biweekly (table 2). In addition, sebum content was significantly lower for the same side (table 1). Taken together, these results suggest that MDA procedure with an interval of two weeks leads to more significant changes in sebum content of skin barrier.

It seems that increased water content of stratum corneum is responsible for smoothness and improvement in the texture of skin.^{16, 17} Rajan et al¹¹ reported the increase of skin hydration after MDA and it may suggest how MDA exerts its effect on improving skin clinical appearance. We could not



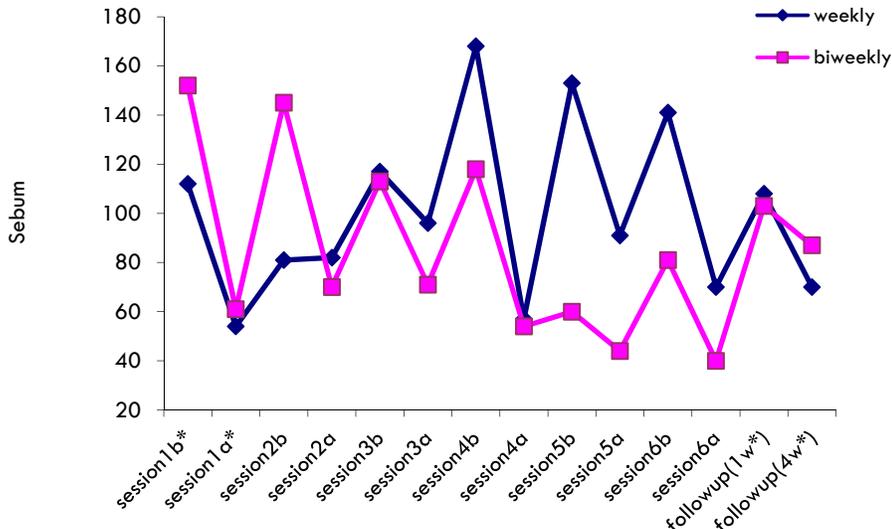
1w*: 1 week after final treatment
4w*: 4 weeks after final treatment

Figure 1: Patients satisfaction from weekly and biweekly microdermabrasion

show any significant changes in skin hydration after MDA, but the increase in skin hydration of the biweekly treated side may indicate more possible beneficial effects of this protocol.

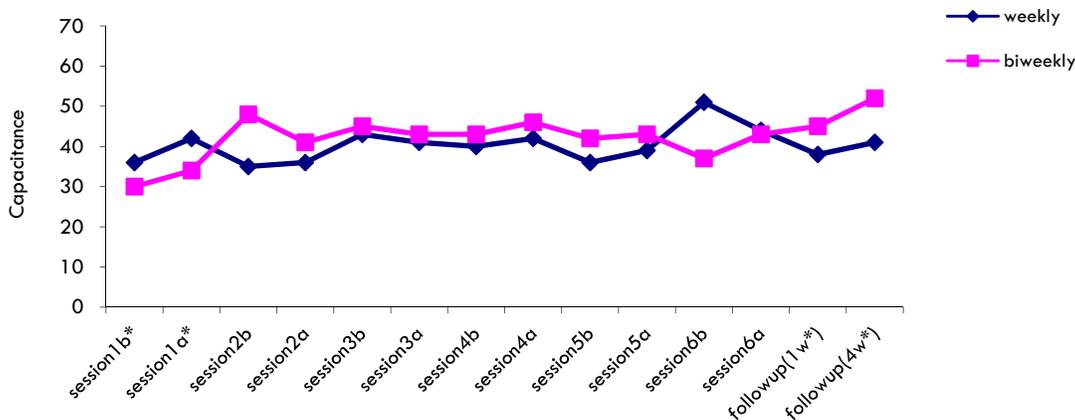
low sample size and future studies may need to enroll more patients in order to demonstrate significant changes in skin hydration of the biweekly protocol.

The major limitation of this study is its relatively



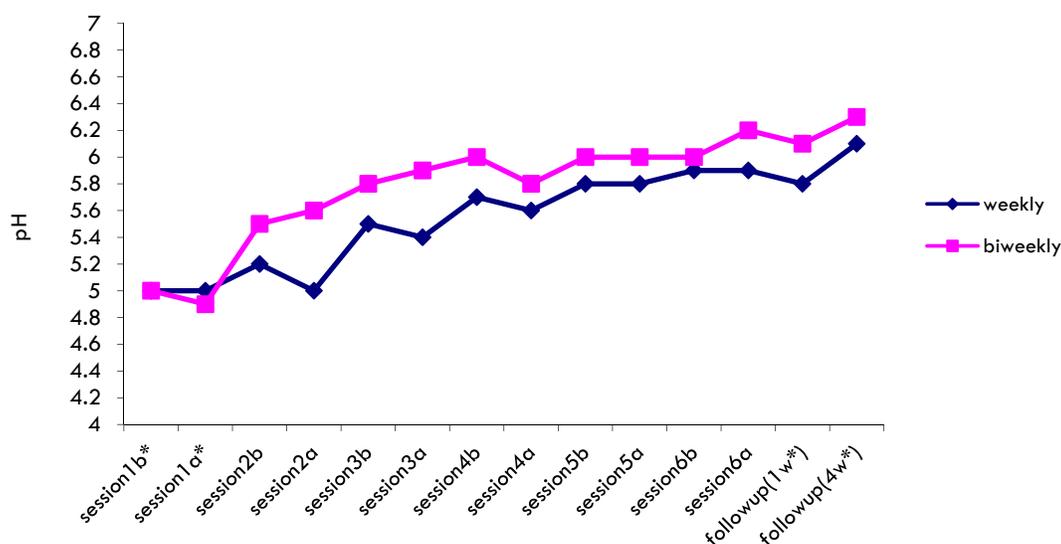
a*: after MDA procedure
 b*: before MDA procedure
 1w*: 1 week after final treatment
 4w*: 4 weeks after final treatment
 Significant change from baseline is indicated by asterisk (*).

Figure 2: Skin sebum content



a*: after MDA procedure
 b*: before MDA procedure
 1w*: 1 week after final treatment
 4w*: 4 weeks after final treatment
 Significant change from baseline is indicated by asterisk (*)

Figure 3: Skin water content



a*: after MDA procedure
 b*: before MDA procedure
 1w*: 1 week after final treatment
 4w*: 4 weeks after final treatment
 Significant change from baseline is indicated by asterisk (*)

Figure 4: Skin PH

Table 1: Comparison of weekly and biweekly microdermabrasion sessions on skin biophysical values

		Median (IQR*)	Baseline	At the end of treatment sessions	Follow-up 1 (1 week after last session)	Follow-up 2 (4 weeks after last session)
			P value			
Sebum (µgr/cm ²)	Weekly	Median (IQR*)	112.0 (206.7)	70.5 (47.2)	108.0 (126.5)	70.5 (63.5)
	Biweekly	Median (IQR*)	152.0 (190.5)	40.0 (30.2)	103.0 (172.0)	87.0 (103.2)
		P value	0.95	0.01	0.86	0.24
Hydration	Weekly	Median (IQR*)	36.8 (19.1)	44.0 (15.5)	38.5 (15.5)	41.0 (17.5)
	Biweekly	Median (IQR*)	30.5 (24.2)	43.5 (11.0)	45.0 (19.2)	52.5 (18.0)
		P value	0.34	0.72	0.26	0.07
pH	Weekly	Median (IQR*)	5.0 (1.5)	5.9 (0.8)	5.8 (0.5)	6.1 (0.6)
	Biweekly	Median (IQR*)	5.0 (1.0)	6.2 (0.3)	6.1 (0.4)	6.3 (0.7)
		P value	0.44	0.17	0.05	0.38

IQR*: Interquartile Range

Table 2: Changes in skin biophysical variables (median values) from baseline

		At the end of treatment sessions	P value	Follow-up 1 (1 week after last session)	P value	Follow-up 2 (4 weeks after last session)	P value
Sebum (µgr/cm ²)	Weekly	-41.5	0.20	-4.0	0.95	-41.5	0.24
	Biweekly	-12.0	0.02	-49.0	0.73	-65	0.61
Hydration	Weekly	+7.2	0.38	+1.7	0.95	+4.2	0.60
	Biweekly	+13	0.09	+14.5	0.12	+22.0	0.03
pH	Weekly	+0.9	0.07	+0.8	0.02	+1.1	0.005
	Biweekly	+1.2	0.004	+1.1	0.01	+1.3	0.006

Berardesca et al¹⁸ suggested that total stratum corneum removal results in increased pH values, but partial removal causes an acidic environment. Additionally, it is reported that an acidic pH environment is required for lipid barrier recovery.¹⁹

In the present study, an increase in pH values from baseline was observed in follow-ups on both sides and at the end of treatment sessions only on the side undergoing biweekly MDA (table 2). Since the data of this study did not provide strong

evidence for lipid barrier regeneration, it is not possible to document the influence of MDA-induced pH changes on restoration of the lipid barrier.

In fact, improved appearance of skin after MDA may be the result of skin barrier function alterations.¹¹ Damages to stratum corneum induced by MDA is responsible for these alterations as well.²⁰ Indeed, the frequency of induced damages and the amount of time needed between these damages influence the results of MDA technique. Regarding the results of this study, two-week intervals may help to achieve more favorable outcomes. Undoubtedly, other technical and operator dependent factors affecting the depth of induced injury, indication of MDA, final goal of the treatment and patient's tolerability should be considered to determine the optimal treatment intervals. Moreover, histopathologic and molecular investigations accompanied by clinical studies may further clarify the effect of different treatment intervals.

Acknowledgments

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