




REVIEW ARTICLE

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Facial cleansing with a sonic brush—A review of the literature and current recommendations

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Summary

Introduction: Skin cleansing is important for removal of dirt, debris, and sebum and plays an important role in reduction of pollution-induced skin aging. Cleansing is an established part of treatment recommendations and procedures in dermatology. Different methods for facial skin cleansing are established but recommendations on use of special devices are not fully integrated into clinical practice.

Aim: We review the current literature on sonic cleansing to demonstrate that a gentle and effective cleansing routine using a sonic brush followed by appropriate additional methods for rehydration and skin protection may improve both inflammatory conditions including acne vulgaris and skin damage associated with overexposure to exogenous light and pollution.

Methods: A working group of experienced clinicians managing facial inflammatory skin conditions convened for a meeting. The panel reviewed the literature surrounding sonic brush cleansing and discussed clinical questions aiming to optimize facial cleansing outcomes.

Results: The panel agreed there are increasing concerns over the rise of atmospheric pollution globally and its impact on health and skin aging and that cleansing in combination with nonspecific skin care is able to support physiological microenvironmental skin conditions including pH levels on the skin surface, barrier function, and hydration.

Conclusion: Cleansing poses a challenge in balancing debris removal while avoiding excess sebum removal, thereby maintaining an intact stratum corneum barrier. The sonic brush may offer a safe and effective treatment for various conditions.

KEYWORDS

facial cleansing, mechanobiology, oscillatory sonic brush

1 | INTRODUCTION

Skin cleansing is a fundamental and established part of treatment for various conditions in dermatology. There are increasing

concerns over the rise of atmospheric particulate global pollution and its impact on systemic health and skin aging. Cleansing of the face is important for removal of dirt, sebum, and debris. Effective cleansing clears pores of debris, allowing sebum to leave the skin

surface unimpeded. Cleansing and moisturizing help to manage pH levels of the skin, enabling sufficient water retention.¹ Cleansing of the face is a delicate balance between the removal of excess sebum and the maintenance of an intact stratum corneum barrier. Special attention is to be given to extrinsically triggered skin aging by airborne pollution² increasing the need for mild but efficient cleansing methods. Although a number of positive effects of different applications of ultrasound on the skin have been reported, the research did not focus on skin cleansing. As the mechanism of action differs, effects of therapeutic ultrasound shown for various dermatological indications may not be applicable when used for skin cleansing.^{3,4}

An oscillatory sonic brush (Clarisonic) uses the skin's elastic properties by applying an optimal amplitude and frequency range to efficiently remove dirt and debris.⁵ The sonic brush has been shown to be safe and effective at cleansing the skin for various dermatologic conditions.⁵

The current review aimed to explore the therapeutic relevance and challenges in facial cleansing using the oscillatory sonic brush. For this purpose, laboratory studies and clinical data on facial cleansing using the cleansing device are reviewed and discussed. In this process, the document will also address the role of facial cleansing in inflammatory skin conditions. Other types of skin conditions are outside the scope of this document and will not be discussed.

2 | METHODS

A working group of clinicians with experience in managing facial inflammatory skin conditions convened for a 1-day meeting. During the meeting, the panel discussed a detailed summary of the results of the systematic literature searches while addressing clinical questions aiming to optimize facial cleansing outcomes.

Literature was reviewed with a focus on facial inflammatory skin conditions, specifically those reporting on the use of the sonic brush. Special attention was given to mechanobiological aspects of facial skin cleansing while maintaining skin barrier integrity.⁶

3 | RESULTS

3.1 | Mechanobiology assay

Mechanobiology is looking at modifications to biological tissues and cells subjected to physical forces that can promote their development, influence their physiology, or cause illness. The underlying mechanisms, that is, the relation between physical stimulus and molecular response, are far from being understood.⁷ Mechanobiology tests place cells under mechanical stress, that is, twisting, pulling, pressure, and shearing, to observe how they behave. The application of cyclic mechanical stimulation induces an increased expression of certain dermal-epidermal junctions and dermal proteins *ex vivo* in human skin. The protein expression depends on the mechanical

character of the stimulus frequency and displays a maximum around a frequency of 75 Hz.⁵

The frequency of mechanical stress is a fundamental stimulating parameter, in particular for cutaneous fibroblasts. This kind of dynamic mechanical stimulation may lead to amplification effects *in vivo*, of the anti-wrinkle effect obtained by regular use of an antiaging cosmetic regimen.

3.2 | In vitro and in vivo studies using the oscillatory sonic brush

A study to understand effects of use of ultrasonic devices in facial cleansing was conducted by Caberlotto et al.⁵ The *ex vivo* study indicated the model to be of interest for understanding biological effects of mechano-transduction at the tissue level. Histological analysis and expression of proteins showed that under experimental conditions the tissue that was exposed to a soft mechanical impulse responded with an increased synthesis of skin structural proteins.⁵ The *in vivo* randomized clinical trial on 42 Caucasian women aged 65-75 years, showed an effect on connective tissue enabling definition of an optimal application frequency (Figure 1).⁵ The *in vivo* study further demonstrated that application of the device in combination with an anti-wrinkle cream may amplify a reduction of the severity of facial wrinkles, improving texture but may also significantly reduce sagging effects, which were not recorded by application of the facial cream alone.⁵

3.3 | Clinical studies using the sonic brush

3.3.1 | Safety of use

As demonstrated by Draelos in 2006,⁶ the use of the oscillatory sonic brush is safe (compared to stand-alone use of a cleanser) and did not cause erythema or other clinical signs of irritation. These findings were supported by work of Akridge et al.⁸ Safety, as well as efficacy, of use of the sonic brush was repeatedly demonstrated by a number of other publications.⁹⁻¹⁴ In addition, the safety of the device on different areas of the face, such as deep pore areas around the nose and mimic wrinkles¹¹ and the periorbital region, has been demonstrated.^{14,15}

3.3.2 | Safety in combination with topical treatment

Safety and efficacy of use of various topical preparations, for example, cleansers and skin care products,^{14,16,17} in combination with the sonic brush was shown for a number of different indications. The indications include among others seborrheic dermatitis,^{18,19} acne,^{9,13,15,20,21} and rosacea.²² A small pilot study¹⁸ of 20 subjects showed a statistically significant improvement in the signs and symptoms of seborrheic dermatitis, from baseline compared to both 1 and 2 weeks, particularly in the sonic brush group.¹⁸

There is clinical experience for its prolonged use for daily facial cleansing^{23,24} and for use after intense pulse light treatment.²⁵

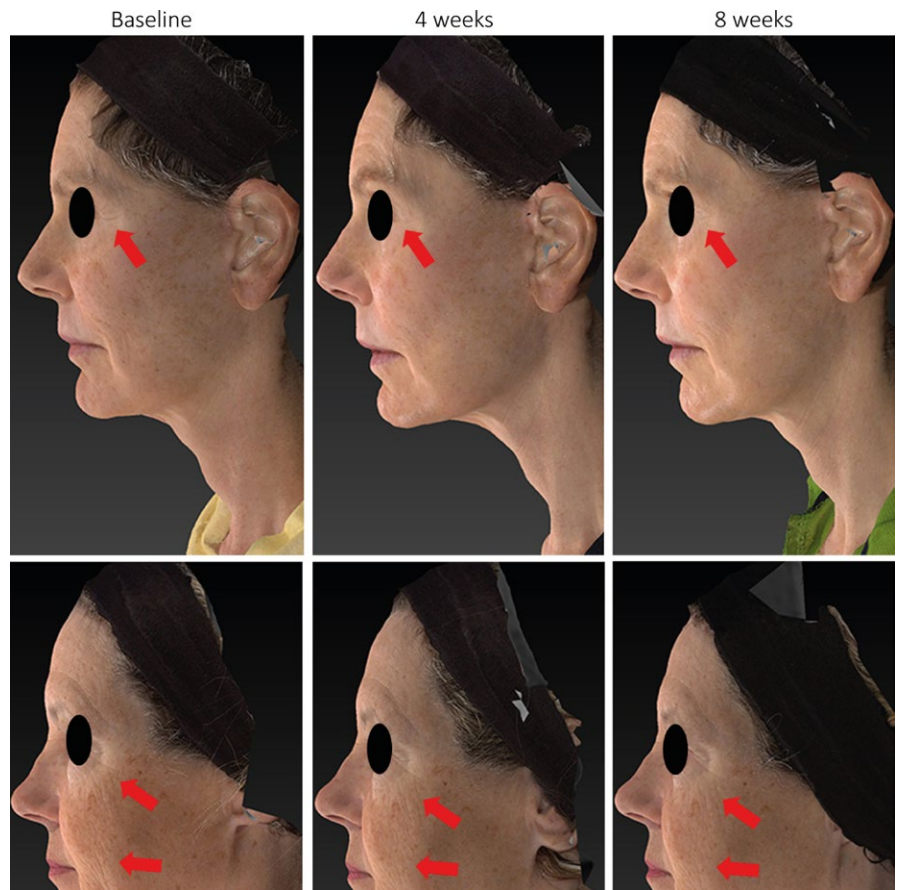


FIGURE 1 Global wrinkle improvements were demonstrated during study. Example of two volunteers in Group 2 (cream plus sonic brush) before (baseline), after 4 wk and after 8 wk of treatment.⁵ The photographs illustrate an improvement of global facial wrinkles. Arrows point out specific areas of interest. The journal⁵ confirmed that the photographs can be used and that no permission is needed

3.4 | Efficacy in cleansing and in improving barrier function

The cleansing device was able to support hydration and skin barrier function (as demonstrated by Transepidermal water loss [TEWL]).⁶

3.4.1 | Use of the oscillatory sonic brush for skin aging

The sonic device has been effectively used for treatment of extrinsic skin aging.^{1,2} Vierkötter et al² assessed the association of particulate pollution in pigmented spots on the forehead.² There is evidence indicating that removal of atmospheric particulate pollutants may reduce complications induced by these substances.^{1,2,26,27}

By implementation of a sebum, oil, and particulate pollution model for assessing cleansing efficacy of human skin, Peterson and colleagues²⁷ were able to demonstrate the efficacy of the sonic brush in cleansing procedures. A significant difference was demonstrated compared to manual cleansing (Figure 2).^{27,28}

By applying a makeup removal model to evaluate the efficacy and safety of various facial cleansing methods,²⁹ the sonic brush showed better cleansing results compared to manual methods.

Performing a split-face study on 22 patients, Henes and colleagues¹⁶ were able to demonstrate a greater improvement on the side treated with the sonic brush in combination with topical antiaging products (vitamin C, idebenone, and peptides based) for appearance of fine lines and wrinkles ($P < 0001$), skin softness ($P < 001$), and skin firmness ($P = 0001$) as well as a significant higher absorption of ascorbic acid after an 8-week period.¹⁶

3.5 | Unpublished clinical studies

Additionally, our working group of clinical experts critically reviewed two unpublished studies to explore the role of the facial cleansing brush for acne-prone skin and other facial inflammatory skin conditions. The patients were permitted to continue the use of prescription and over the counter acne treatments during the study.

The first study was performed as a split-face study comparing cleansing efficacy when using the oscillatory sonic brush and cleanser vs manually applying the same cleanser. Thirty female subjects (aged 27-65 years) were included, and for each subject, test site was chosen. The degree of fluorescence was graded on a 5-point scale at day 1, 2, 5-9, 12-16, and 19-23, respectively. Both in visual skin kinetics and in time for epidermal cell turnover, the cleansing device was superior in use compared to the untreated site at days 2, 5-9, 12-16, and 19-23. An overview of these results is given in Figure 3.



FIGURE 2 Fluorescent makeup methodology used to measure the cleansing efficacy the sonic brush. Amount of SPM (artificial sebum + pollution) remaining on the skin after cleansing with a sonic brush vs. manual cleansing (using same cleanser).²⁷ Photographs shown at baseline (2-1), before cleansing (2-2) after application of SPM), and after cleansing (2-3).¹⁹ Permission is obtained for use of the photographs. License is attached

In a second study, 52 women (aged 20-44 years) with acne-prone skin (86.5% oily and 13.5% mixed-oily skin conditions) with a tendency to acne lesions applied the ultrasonic brush (standardized in combination with a cleansing gel) once a day (in the evening). After a 4-week period of treatment, there was an improvement of 15.6% for open and closed comedones and an improvement of 51.4% for inflammatory lesions.

4 | DISCUSSION

Sonic cleansing supports daily tasks, for example, removal of sun cream or makeup.^{29,30}

Cleansing using the sonic brush may offer benefits for inflammatory skin conditions as established in a number of studies.^{1,6,8,18-20,31}

The presented studies indicate that the use of the sonic brush offers an efficient and safe technique for cleansing and for improvement in skin barrier maintenance.⁹⁻¹⁴ A significant advantage in efficacy in antiaging and anti-acne skin care regimes has been shown

when using the sonic brush compared to typical manual cleansing procedures with and without skin cleansing products.^{1,2,26,27}

The evidence on short- and long-term biological effects of therapeutic ultrasound may not be applicable to sonic brush use due to large differences between the two types of devices concerning electromagnetic energy density, frequency of application and performance. However, the effects on tissue⁵ that were shown, such as increased synthesis of structural proteins of the skin, may serve as a baseline for research on antiaging effects using the sonic brush.^{16,26}

Reflecting on extrinsic factors triggering aging of the skin may lead to a better understanding of the underlying mechanisms.^{1,2,26-28} Most skin models used for research were developed from understanding collagen and its role in skin aging. However, skin aging is a more complex and dynamic process of changes in the biophysical network structures.³⁴ Additionally, the absence of suitable substrates to create a microenvironment that has the correct ratio of elastic and viscoelastic components in tissues may result in errors.^{1,6}

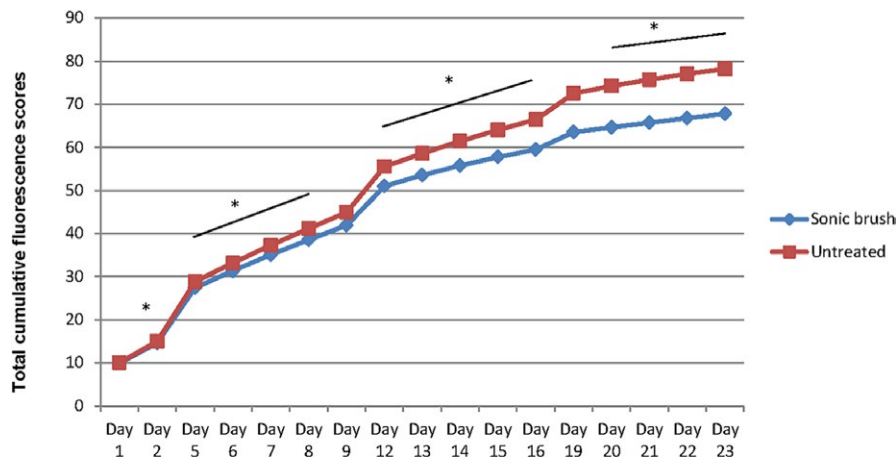


FIGURE 3 Total cumulative fluorescence scores for each subject and treatment for sites treated with the sonic brush and untreated control. Both in visual skin kinetics and in time for epidermal cell turnover, the sonic brush was superior in use compared to the untreated site at days 2, 5-9, 12-16, and 19-23. The sites treated with the brush showed statistically lower total fluorescence scores ($P < 0.001$) relative to those of the untreated control sites at days 2, 5-9, 12-16, and 19-23 evaluation. Clarisonic, data on file, permission for use was granted by Clarisonic



FIGURE 4 The oscillatory sonic brush used in the studies discussed in the review. Clarisonic, permission for use was granted by Clarisonic

Research on sonic brush use could target mechanobiological questions offering a different perspective, including positive effects on visual skin kinetics as demonstrated in in vivo studies on sonic brush use, may be a way forward to enhance knowledge.

Further robust studies are required to verify indications and possible combinations of treatment using the sonic brush.

5 | CONCLUSIONS

Skin cleansing is important for removal of dirt, excess sebum, and debris. It is an established part of treatment recommendations and is supported by various dermatological findings.

Cleansing involves a challenging balance between the removal of excess sebum and the maintenance of the stratum corneum barrier.

The oscillatory sonic brush has been shown to be a safe and effective cleansing device for various dermatologic conditions, improving TEWL and skin barrier. Treatment of both extrinsic aging and inflammatory conditions including acne improve with the use of sonic cleansing.

Removing pollutants using the sonic brush may limit skin damage associated with overexposure to atmospheric particulate pollution.

6 | OSCILLATORY SONIC BRUSH

The oscillatory sonic brush (Clarisonic Mia 2) charger should be used keeping the safety measures in mind (Figure 4). The handle of

the sonic brush is waterproof for use in the shower or bathtub. The sonic brush may be used with specific cleansers that are optimized for daily use or with soft rounded exfoliating particles containing products. The brush heads should not be shared to prevent contamination. Prior to the first use, the device is to be charged for 24 hours. Instructions for use:

- Remove eye makeup by hand.
- Apply cleanser directly to moistened skin or to a damp brush head.
- Turn the device on and select the desired speed. There are two settings, normal and low.
- Follow T-Timer prompts while gently moving brush head in small circular motions. The brush will automatically shut off after the cleansing cycle.
- Rinse skin thoroughly to remove excess cleanser.

Cleanse the handle and the brush once a week with warm soapy water to remove residue. Brush heads need to be replaced every 3 months.

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