CASE STUDY

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Minimally invasive facial skin revitalization treatment – a case study

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ABSTRACT

The increasing longevity of today's societies has created a considerable need for the revitalization of facial skin undergoing the ageing processes. It is important to undertake preventive measures and start therapy when the first signs of ageing appear. This makes it possible to achieve a satisfactory effect while using minimally invasive procedures. Among them, treatments based on autologous preparations occupy a significant place, such as those using stem cells and concentrated growth factors (CGF), which have recently been introduced on the Polish market. Such a procedure was used on the patient described in this paper. In a series of instrumental studies, after three administrations of CGF-Harmony, improved values for the measurements reflecting skin elasticity were obtained, which was confirmed by instrumental examination of the skin using a Cutometer Dual MPA 580. Instrumental analysis of the mechanical parameters of facial skin makes it possible to demonstrate the effectiveness of treatment in the field of facial aesthetic medicine.

Keywords: face, revitalization, CD34+ stem cells, concentrated growth factors (CGF).

Introduction

When planning facial skin rejuvenating or revitalizing therapy (Latin re-vita: restoring to life, reviving) practitioners in facial aesthetic medicine base their knowledge on the current canons of beauty and anthropometric measurements. The individual predispositions of patients mean that there is no universal way of maintaining the good condition of facial skin. In addition to correctly diagnosing the specific needs of each patient, the physician should be familiar with the anatomy and morphology of the face, take into account the principles of biophysics, and possess a unique sense of aesthetics [1, 2]. However, taking into account the existing norms and canons of beauty is not enough. When planning a course of treatment, the practitioner should also focus on the psycho-aesthetic aspect, i.e. looking at the face through the prism of the patient's expectations. Everyone has their own subjective way of perceiving attractiveness, which is determined by such factors as individual preferences, sensitivity to and subjective perception of beauty, cultural aspects as well as pressure from the media or society, especially peer groups; and these factors may be different for the doctor and the patient [3]. One of the first signs of ageing is the thinning of the skin around the eyes, especially in the area of the lower eyelid [4, 5]. The rate of these changes depends on the natural predispositions of the

body, e.g. a decrease in the number of fibroblasts or in hormone levels, but also on external factors such as smoking, exposure to the sun and artificial UV sources, and many others [1, 3].

CD34+ stem cells and concentrated growth factors (CGF)

A recent development on the market of facial aesthetic medicine services is a treatment based on the application of natural stem cells and growth factors in the form of a gel. The procedure begins with obtaining the patient's venous blood, to which low molecular weight heparin is then added and the mixture undergoes centrifugation in a special blood cell separator. The separator is a highly technologically advanced device because it has electrostatic and electromagnetic shielding and a range of different centrifugation speeds programmed, which makes it possible to obtain stem cells while at the same time protecting the delicate morphotic elements from damage. As a result, 3 plasma layers are obtained: the upper layer – platelet poor plasma (PPP), which will be heated to 75 degrees Celsius, producing the aggregation of albumins and forming an APAG gel (Activated Plasma Albumin Gel); the middle layer –platelet rich plasma (PRP); and the deep layer – between the erythrocytes and PRP (approximately 0.4 ml), containing CD34 + stem cells.

During the process of obtaining CGF, the growth factors in the blood platelets and stem cells are concentrated 16 times in relation to the initial quantity contained in peripheral blood [6]. From above the erythrocyte layer the concentrated growth factors fraction, together with the stem cells, are obtained and combined with the APAG gel, which after application significantly extends the duration of the preparation's therapeutic action (up to 7 days). This is especially important in cases requiring more effective stimulation. Stem cells have a regenerative effect; among other things, they stimulate angiogenesis, they can differentiate into fibroblasts and keratinocytes, as well as stimulating the stem cells present in the epidermis and dermis for immediate regeneration of the skin through the released growth factors. Therefore, the prolonged release of growth factors using the CGF-Harmony procedure is more beneficial than using other autologous preparations [7].

The predictability of treatment results and a successful final outcome depend on the correct diagnosis of the patient and determining realistic treatment goals after a comprehensive analysis of their facial skin. There is a wide variety of skin revitalization methods. Some treatments offered by facial aesthetic medicine give almost immediate effects; others, such as the application of stem cells and growth factors, more gradually, but quite quickly and noticeably improve the appearance and structure of the skin. Aesthetic medicine procedures are increasingly popular among women, especially those that produce a relatively quick desired aesthetic effect, involve few potential complications and ensure patient satisfaction. Such treatments, which include the use of autologous preparations, enable women to lead a "race against time" and "improve nature" without the need for hospitalization or even temporarily withdrawing from their working lives [8].

The aim of this study was to show the effect of the changing values in the mechanical parameters of facial skin after three applications of stem cells and growth factors (CGF Harmony).

Case study

A 40-year-old female patient came to the Facial Aesthetics Laboratory/Centre in the Chair of Maxillofacial Orthopaedics and Orthodontics at the Poznań University of Medical Sciences in order to improve the appearance of her skin and enhance the contour of her face. According to her medical history, the patient had not had any cosmetic procedures before, except for an irregular use of face creams, mainly moisturizers of various brands. As regards facial medicine procedures, the woman had undergone a treatment based on an autogenic preparation (PRP) preceded by a Nomelan Cofeico chemical peel. One year later, the patient decided to again try a facial aesthetic medicine treatment, and the CGF Harmony procedure was recommended to her. The mechanical parameters of the facial skin were examined using a Cutometer Dual MPA 580, assessing parameters R0 to R9 at fixed measurement sites (**Figure 1**) four times: before the three applications of CGF Harmony; after six months between the 1st and 2nd treatment; two months later; and finally after another 2 months (**Table 1**). After the first application, the patient reported a persistent

Figure 1. Measurement sites

and long-lasting (about two weeks), though difficult to specify, discomfort of the facial skin with minor bruising and swelling, hence she decided to have the second treatment after 6 months. After the second application the patient did not experience such long-lasting discomfort, it passed after a few days, and there was just slight bruising and swelling. After the final application the reaction was decidedly milder, with only very slight bruising and no swelling.

Justification for the proposed medical procedure

CGF Harmony was recommended because of the proven regenerative properties of stem cells and concentrated growth factors; their synergistic actions stimulating skin repair processes, including angiogenesis, which are adapted to the skin's needs and the body's capabilities; as well as anti-inflammatory properties which accelerate healing, preventing scarring or keloids. The treatment guaranteed obtaining improvement in the facial contour as well as skin firmness, elasticity and tone, and, consequently, reducing fine lines and restructuring the facial skin in the most natural and physiological way.

All the tests were carried out under the same conditions, at a temperature of 21° C and with air

Table 1. Values for the mechanical parameters of the patient's facial skin in a series of tests

EYE BOTTOM												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.16	0.18	0.17	0.26	0.27	0.27	0.29	0.34	0.32	0.31	0.27	0.29
R1 [a.u.]	0.05	0.7	0.38	0.1	0.11	0.11	0.09	0.11	0.10	0.1	0	0.05
R2 [a.u.]	0.69	0.59	0.64	0.62	0.61	0.62	0.7	0.67	0.69	0.67	1	0.84
R3 [mm]	0.2	0.24	0.22	0.31	0.32	0.32	0.35	0.42	0.39	0.39	0.58	0.49
R4 [mm]	0.08	0.11	0.10	0.13	0.11	0.12	0.1	0.19	0.15	0.16	0.2	0.18
R5 [a.u.]	0.85	0.63	0.74	0.53	0.44	0.49	0.62	0.66	0.64	0.59	0.78	0.69
R6 [a.u.]	1.22	0.97	1.10	0.74	0.5	0.62	0.7	1.05	0.88	1.05	0.6	0.83
R7 [a.u.]	0.38	0.32	0.35	0.3	0.29	0.30	0.36	0.32	0.34	0.29	0.49	0.39
R8 [mm]	0.11	0.11	0.11	0.16	0.17	0.17	0.21	0.23	0.22	0.21	0.27	0.24
R9 [mm]	0.04	0.06	0.05	0.05	0.05	0.05	0.05	0.08	0.07	0.09	0.31	0.20
R8/R0 [%]	68.75	61.11	64.93	61.54	62.96	62.25	72.41	67.65	70.03	67.74	100.00	83.87
EYE TOP												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.23	0.24	0.24	0.36	0.35	0.36	0.37	0.38	0.38	0.42	0.42	0.42
R1 [a.u.]	0.07	0.02	0.05	0.13	0.12	0.13	0.16	0.09	0.13	0.18	0.02	0.10
R2 [a.u.]	0.71	0.94	0.83	0.66	0.65	0.66	0.56	0.76	0.66	0.57	0.96	0.77
R3 [mm]	0.29	0.33	0.31	0.42	0.4	0.41	0.44	0.43	0.44	0.51	0.35	0.43
R4 [mm]	0.08	0.02	0.05	0.21	0.17	0.19	0.21	0.1	0.16	0.26	0	0.13
R5 [a.u.]	0.68	1.03	0.86	0.44	0.5	0.47	0.41	0.61	0.51	0.43	0.59	0.51
R6 [a.u.]	0.99	1.12	1.06	0.53	0.45	0.49	0.58	0.69	0.64	0.77	0.86	0.82
R7 [a.u.]	0.34	0.49	0.42	0.29	0.35	0.32	0.26	0.36	0.31	0.24	0.32	0.28
R8 [mm]	0.16	0.22	0.19	0.24	0.23	0.24	0.2	0.29	0.25	0.24	0.4	0.32
R9 [mm]	0.06	0.1	0.08	0.05	0.05	0.05	0.07	0.05	0.06	0.08	-0.06	0.01
R8/R0 [%]	69.57	91.67	80.62	66.67	65.71	66.19	54.05	76.32	65.18	57.14	95.24	76.19

Table 1 continued

CHEEK												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.28	0.26	0.27	0.36	0.35	0.36	0.31	0.31	0.31	0.24	0.27	0.26
R1 [a.u.]	0.05	0.03	0.04	0	0	0.00	0	0	0	0	0	0.00
R2 [a.u.]	0.82	0.88	0.85	1	1	1.00	1	1	1	1	1	1.00
R3 [mm]	0.33	0.31	0.32	0.41	0.39	0.40	0.36	0.36	0.36	0.29	0.31	0.30
R4 [mm]	0.09	0.04	0.07	0.07	0.06	0.07	0	0	0	0	0.05	0.03
R5 [a.u.]	0.67	0.96	0.82	0.68	0.63	0.66	0.96	0.96	0.96	1.88	0.61	1.25
R6 [a.u.]	0.78	0.83	0.81	0.54	0.53	0.54	0.72	0.72	0.72	1.6	0.58	1.09
R7 [a.u.]	0.38	0.52	0.45	0.44	0.41	0.43	0.56	0.56	0.56	0.72	0.38	0.55
R8 [mm]	0.23	0.22	0.23	0.36	0.35	0.36	0.31	0.31	0.31	0.24	0.27	0.26
R9 [mm]	0.06	0.05	3.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05
R8/R0 [%]	82.14	84.62	83.38	100.00	100.00	100.00	100.00	100.00	100	100.00	100.00	100.00
LIPS BOTTOM												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.27	0.24	0.26	0.32	0.42	0.37	0.36	0.37	0.37	0.28	0.43	0.36
R1 [a.u.]	0.04	0.03	0.04	0	0.05	0.03	0	0	0.00	0.07	0.01	0.04
R2 [jau.]	0.85	0.86	0.86	1	0.87	0.94	1	1	1.00	0.74	0.99	0.87
R3 [mm]	0.33	0.3	0.32	0.37	0.47	0.42	0.41	0.43	0.42	0.32	0.44	0.38
R4 [mm]	0.06	0.04	0.05	0	0.06	0.03	0	0	0.00	0.1	0.05	0.08
R5 [a.u.]	1.01	1.14	1.08	0.8	0.72	0.76	1.32	1.02	1.17	0.54	0.5	0.52
R6 [a.u.]	0.92	0.9	0.91	0.5	0.49	0.50	0.62	0.81	0.72	0.47	0.29	0.38
R7 [a.u.]	0.52	0.6	0.56	0.53	0.49	0.51	0.81	0.56	0.69	0.37	0.39	0.38
R8 [mm]	0.23	0.2	0.22	0.32	0.37	0.35	0.36	0.37	0.37	0.21	0.42	0.32
R9 [mm]	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.04	0.01	0.03
R8/R0 [%]	85.19	83.33	84.26	100.00	88.10	94.05	100.00	100.00	100.00	75.00	97.67	86.34
LIPS TOP												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.27	0.29	0.28	0.41	0.26	0.34	0.3	0.33	0.32	0.32	0.39	0.36
R1 [a.u.]	0.04	0.09	0.07	0.05	0	0.03	0	0	0.00	0.06	0.08	0.07
R2 [a.u.]	0.86	0.7	0.78	0.88	1	0.94	1	1	1.00	0.82	0.8	0.81
R3 [mm]	0.32	0.34	0.33	0.46	0.3	0.38	0.34	0.39	0.37	0.33	0.42	0.38
R4 [mm]	0.06	0.11	0.09	0.1	0	0.05	0	0	0.00	0.1	0.11	0.11
R5 [a.u.]	1	0.68	0.84	0.68	0.94	0.81	1.02	1.26	1.14	0.58	0.52	0.55
R6 [a.u.]	0.73	0.52	0.63	0.48	0.72	0.60	0.63	0.88	0.76	0.55	0.28	0.42
R7 [a.u.]	0.58	0.44	0.51	0.46	0.55	0.51	0.63	0.67	0.65	0.38	0.4	0.39
R8 [mm]	0.23	0.2	0.22	0.36	0.26	0.31	0.3	0.33	0.32	0.26	0.31	0.29
R9 [mm]	0.05	0.05	0.05	0.06	0.04	0.05	0.04	0.07	0.06	0.01	0.03	0.02
R8/R0 [%]	85.19	68.97	77.08	87.80	100.00	93.90	100.00	100.00	100.00	81.25	79.49	80.37

humidity in the range of 40–60%. Before each examination, the facial skin was wiped with micellar water and then the patient underwent a 20-minute adaptation to the conditions specified above. The mean values from the 6 measurements obtained at the measurement sites, each no larger than 1 cm^2, on both sides of the face, were analysed.

The mechanical parameters of the patient's skin were similar on both sides of the face, so the condition of the facial skin was considered on the basis of mean values in the measuring cycle. The Cutometer Dual MPA 580 parameters which are responsible for elasticity are R2, R5 and R7 [9]. Favourable changes were observed in the values of these parameters, i.e. skin elasticity in measurements which were distant in time (visit 3 and 4) underwent the expected changes, which was not the case during the second visit. Thus, one can speak of a temporary deterioration in skin elasticity in the case of the six-month interval between the first application of stem cells and concentrated growth factors, and the conducted measurements, as shown by the val-

ues obtained for visits 1 and 2 in the eye area. The R8/R0 parameter ratio also indicates a deterioration in the skin's ability to return to the original shape, as shown by the measurements made between the 1st and 2nd administration of stem cells and concentrated growth factors. The values of all the parameters assessing elasticity on both cheeks indicate improved skin elasticity in the whole series of measurements made after the first CGF-Harmony application. Parameter R9 from the measurements performed on both the right and left cheek, shows a decrease in skin fatigue. Also, the R8/R0 parameter ratio indicates improvement in the skin's ability to return to its original shape. Measurements made around the lips also indicate improved skin elasticity, although in this case the results are not completely definite. The values of parameters R2 and R6 are favourable, whereas the measurements of parameters R5 and R7 show unfavourable values above and below the corners of the mouth. The R8/R0 ratio shows an improvement in the skin's ability to return to the original shape for the measurements made above and below the corners of the lips on both sides of the face. A decrease in skin fatigue, represented by parameter R9, can be observed for the measurements made above and below the corners of the lips on both sides of the face. Thus, a general improvement in the condition of facial skin was obtained, which was measured by means of an objective instrumental method through assessing the mechanical parameters of facial skin.

Discussion

Facial aesthetic medicine is a field undergoing intensive development. However, numerous authors emphasize that there is still a shortage of guidelines; not enough precise instrumental preliminary skin tests for determining the number, duration and series of treatments [10]; as well as inadequate standardization of administration procedures and specification of methods for dealing with complications that may arise. This, even in peeling, platelet rich plasma or mesotherapy treatments, may be connected with some risk, also associated with a lack of expected results [11–15]. The skin of a woman over 40 years of age requires care which involves both cosmetic and aesthetic medicine treatments because the symptoms of skin ageing are clearly visible at this stage [16–18]. In the case described in this paper the patient did not take systematic care of her facial skin. In any specialist therapy, including the field of aesthetic medicine, medical photographic documentation is created as a standard [19, 20]; however, instrumental measurements of mechanical skin parameters are rarely made [21, 22]. It is also possible to measure other physical parameters such as TEWL (transepidermal water loss), skin redness and hydration [3]. The R0-R9 parameters analysed in this study refer to the elasticity and firmness of facial skin. The closer the R2, R5 and R7 parameters are to 1 (100%), the higher the skin's elasticity. The R5 parameter is the only one that can have a value above 1, which indicates skin that is very elastic and hydrated or very thin. The values of these three parameters at the measuring sites in the presented case improved. In the case of parameter R6 the lower its value, the greater is the elasticity of the skin. Parameters R3, R4 and R9 relate to "skin fatigue". The ratio of parameter R8 to parameter R0, which represents the skin's ability to return to its original shape, was also calculated (as a %) and a very favourable result was obtained. However, in the examined patient the reaction of the skin to the treatments was quite unusual: there was a hyper-reaction which could still be observed 6 months after the first CGF Harmony application, and perhaps this was why it was impossible to definitively identify any favourable trends in the mechanical parameters of the skin in the two subsequent tests (3 and 4). Environmental factors such as exposure to the sun (variable throughout the year); influence of the seasons and related temperature and diet changes; a change of cosmetics; as well as the circumstances of the measurement itself (e.g. humidity and air pressure, the experimenter's experience in taking measurements, the way of holding the probe or the pressure of the instrument on the skin) play a significant role. It is crucial that all the measurements should be performed by one person [10, 22]. In the case described in this paper, all the conditions, namely the correct preparation of the face, the required adaptation time and one person performing the measurements, were fulfilled.

The case described in this paper shows that with an accurate assessment of the condition of the skin before and after the procedure based on

an instrumental examination, the application of CGF Harmony can, in the long term, improve the facial skin condition of a women over the age of 40 whose skin problems were not very advanced. It remains to be considered how many and at what intervals CGF Harmony treatments should be performed. However, it seems that in the presented case the Nomelan Cafeico peel treatment (which is a series of three peels applied in layers over each other) administered about a year before the application of CGF Harmony as well as a single application of PRP played a certain role. The choice of the CGF-Harmony procedure in the case of the described patient seems to be appropriate because it helped to achieve skin revitalization and wrinkle reduction, and also because it made it possible for the patient to quickly return to her daily activities, which was important from the point of view of her professional commitments. After her previous treatments, the patient was particularly interested in effective, medically well-documented and at the same time minimally invasive procedures that could slow down the natural progress of the ageing processes. Such procedures can be expected to be particularly effective when the initial parameters related to skin firmness, elasticity and hydration differ only slightly from the ideal values, and the skin is properly nurtured and preserved in good condition. The desired effect of improving the structure of the facial skin was obtained in the most natural and physiological way possible, which was confirmed by an improvement in the values of the assessed parameters, especially considering the differences between the first and fourth measurements.

Evidence can be found in the literature that aesthetic medicine treatments are an important factor in improving a person's mood. However, internalizing the perfect body image can often mean that the desire to meet excessive beauty standards becomes the most important goal in one's life. It may encourage people to engage in activities aimed at achieving the ideal appearance, which may result in excessive use of aesthetic medicine treatments [23]. This, however, was not true in the case described here as the patient saw the treatment only as a preventive measure.

It is often pointed out in the literature that facial appearance is influenced by many factors, including correctly performed dental procedures [24]. Frequently, the effects of aesthetic treatment are lessened by an unsightly smile, with numerous missing teeth or unmatched prosthetic restorations. In such situations, despite a correctly chosen aesthetic medicine treatment, the general sense of facial aesthetics is low and the patient is not satisfied with the appearance of their profile or the proportions of their face [25]. In the case presented in this paper, the patient had harmonious and complete dental arches, thus the dental requirements related to facial aesthetics were fulfilled.

Conclusions

Instrumental analysis of the mechanical parameters of facial skin makes it possible to demonstrate the effectiveness of treatment.

The CGF-Harmony procedure can help in obtaining a better synergistic overall effect and preserving a young and fresh colour and appearance of facial skin, which naturally is one of the principal goals of facial aesthetic medicine.

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Conflict of interest statement
The authors declare no conflict of interest.

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