Journal of Cosmetics, Dermatological Sciences and Applications, 2019, 9, 30-40
http://www.scirp.org/journal/jcdsa
ISSN Online: 2161-4512
ISSN Print: 2161-4105

Trends of Noninvasive Radiofrequency and Minimally Invasive Treatment for the Management of Facial Aging

Sunghee Kim[1], Moonjong Kim[2*]

[1]Bundang Dongan Anti-Aging Clinic, Seongnam, Republic of Korea
[2]Department of Family Medicine at CHA Bundang Medical Center of CHA University, Seongnam, Republic of Korea
Email: *mjkimfm@cha.ac.kr

How to cite this paper: Kim, S. and Kim, M. (2019) Trends of Noninvasive Radiofrequency and Minimally Invasive Treatment for the Management of Facial Aging. *Journal of Cosmetics, Dermatological Sciences and Applications*, **9**, 30-40.
https://doi.org/10.4236/jcdsa.2019.91003

Received: January 7, 2019
Accepted: January 29, 2019
Published: February 1, 2019

Abstract

Various treatments for the management of facial aging have been performed among which noninvasive radio-frequency (RF; *i.e.*, thermage) treatment and minimally invasive treatments are on the rise. The purpose of this study was to analyze trends of the treatment of facial aging in Korea and to investigate relationships between the use of noninvasive RF and minimally invasive treatments. A retrospective analysis conducted on data from 4021 patients showed that thermage treatment increased by 134.9% over 5 years. As a person ages, the rate of facial treatment with both the botulinum toxin (for the masseter and lines of the glabella, lateral canthus, and forehead) and the PDO thread lift increases. The use of the treatments, nasolabial fold filler and Silhouette Soft Thread, however, was not associated with aging. The patients receiving thermage treatment were less likely to undergo any of the other treatments including PDO thread lift, Silhouette Soft Thread, nasolabial fold filler, or any of the botulinum toxin treatments. Overall, the results showed that patients who had received noninvasive RF tended to receive less minimally invasive treatment.

Keywords

Facial Aging, Noninvasive Treatment, Radio-Frequency, Thermage, Minimally Invasive Treatment

1. Introduction

Today, a growing number of people aspire to have a younger face and cosmetic surgery is becoming increasingly popular worldwide [1]. People are undergoing cosmetic surgery because of its positive effects on their social relationships [2],

body image [3], and self-esteem [4]. Research has found that media exposure and conversations among friends over body dissatisfaction are related to attitudes toward cosmetic surgery [5]. Published recommendations and clinical evidence mostly reference Western, and not Asian attitudes to beauty addressing such ideas as structural facial anatomy and signs and rates of aging. Within the Korean population, having "normal appearance" is considered to be of critical importance and is strongly associated with the face of a person [6].

Facial cosmetic surgery focuses on improving facial appearance *vis-à-vis* injectable fillers, neural modulators, lasers, and other treatments aimed at rejuvenating skin [7]. Practitioners and patients of traditional invasive surgery to remove facial wrinkles, pull up an elongated jawline, cut and exfoliate the skin, and transplant fat to a reduced facial fat layer, should take into account the possibilities of a long recovery time and health complications [8]. Therefore, approaches are on the rise to treat facial aging with minimally invasive treatments and include procedures involving botulinum toxin, filler, and thread lift [9]. Today, botulinum toxin injection is the most commonly performed nonsurgical cosmetic procedure in the world [10] [11].

Traditional surgical intervention and ablative skin resurfacing have been performed to improve facial rhytids from skin laxity, although new methods have evolved that are less invasive and tend to minimize recovery time and risk of postoperative complications. The application of noninvasive radiofrequency (RF) treatment has been steadily increasing over the past several years to accommodate the paradigm shift in facial aging treatment to noninvasive [12]. Thermage control pulse technology (hereafter "thermage") protects the skin surface by the delivery of radio-frequency energy to the dermis, which is known to clinically improve the tightening and contouring of the skin through collagen contraction and remodeling [13]. In 2002, thermage received U.S. Food and Drug Administration approval for treatment of wrinkles around the eyes and in 2004 was approved for treatment for all facial rhytids.

In clinical practice, a wide variety of treatments for the management of facial aging have been conducted. Patients normally have the option to receive one of these procedures or to combine procedures. However, there has been limited data analysis in general of the use of noninvasive RF treatments, and, more specifically of the relationships between the use of minimally invasive and more invasive treatments. This study analyzed the Korean population trends in treatments for the management of facial aging by year and age group exploring correlations between patient use of noninvasive RF and minimally invasive procedures.

2. Methods

Data were collected from chart records of outpatients who were treated from January 2013 to December 2017 for the management of facial aging. The charts of 9110 patients who visited a clinic for facial aging treatment during the study

period were reviewed to narrow the study group to those 4201 patients who had been administered thermage (Thermage® Inc., Hayward, CA), Polydioxanone thread (PDO) thread lift, Silhouette Soft Thread (Poly-I-lactic acid or sculptra solid form), nasolabial fold filler, and botulinum toxin treatments for the masseter and lines of the glabella, forehead, and lateral canthus and fulfilled other criteria (age, gender, date of treatment, detail of treatment) important to the study. The ethical part of this study was approved by the Korean Public Institutional Review Board, which is designated by the Korean Ministry of Health and Welfare (report IRB No. P01-201808-21-013).

Statistical analyses were performed using SPSS 23.0 software (IBM, Somers, USA). The characteristics of patients who received facial aging treatment were summarized using descriptive statistics. Differences between the number of noninvasive RF treatments and minimally invasive treatments by year and age group were analyzed using t-tests and ANOVAs. In addition, a multiple logistic regression was performed of the relationship of the independent predictors of age, gender, year, and type of past treatment PDO thread lift, Silhouette Soft Thread, nasolabial fold filler, and botulinum toxin treatments for the masseter and lines of the glabella, forehead, and lateral canthus, with the general treatment class, being either noninvasive RF or minimally invasive. Data were presented as an odds ratio (OR) with a 95% confidence interval (CI). A value of $p < 0.05$ was considered statistically significant for all tests.

3. Results

The general characteristics of the study subjects are presented in Table 1. For the 4201 patients, the mean age was 42.5 ± 9.6 years (range 20 - 81 years). The

Table 1. Characteristics of subjects who received anti-aging facial treatment (n = 4,201).

		Number of subjects	(%)
Age (years)		42.5 ± 9.6 (mean ± SD)	
	20 - 29	353	8.4
	30 - 39	1301	31.0
	40 - 49	1601	38.1
	50 - 59	758	18.0
	≥60	188	4.5
Gender	Male	286	6.8
	Female	3915	93.2
Treatment year	2013	701	16.7
	2014	789	18.8
	2015	776	18.5
	2016	936	22.3
	2017	999	23.8

majority of the patients were in their forties; 93.2% of the patients were women, and the overall number of patients increased by 42.5% from 2013 to 2017.

The type and number of facial treatments from 2013 to 2017 are presented in Table 2. The maximum number of treatments was 1400 for thermage followed by botulinum toxin treatments. Thermage treatments increased yearly, with a 134.9% growth from 2013 to 2017.

The type and number of treatments for the management of facial aging by age group over the five-year period are presented in Table 3. The 40 - 49 age group had the highest number of overall treatments, which included thermage, PDO thread lift, nasolabial fold filler, and botulinum toxin treatments for the lines of the glabella, forehead, and lateral canthus. The Silhouette Soft Thread treatment was the most common in the 50 - 59 age group, and the masseter botulinum toxin treatment was the most common in the 30 - 39 age group.

The type and number of minimally invasive thermage treatments are presented in Figure 1. The rate of patient use of each of the treatments of PDO thread lift, Silhouette Soft Thread, nasolabial fold filler, and the botulinum toxin treatments, was lower in patients who had received thermage treatment than in patients who had not received thermage treatment ($p < 0.001$).

The results of the logistic regression analysis of the relationship of the independent predictors in terms of the class of thermage treatment (noninvasive RF vs minimally invasive) are shown in Table 4. Overall, as age increases, patients tend to receive thermage treatment ($p < 0.001$). In addition, the > 60 age group used the thermage treatment more than the 20 - 29 age group ($p < 0.001$, OR = 7.866). For gender, women were more likely to undergo thermage treatment than men ($p = 0.003$, OR = 1.698). Based on treatment year, the use of thermage treatment by the patients was higher in 2016 and in 2017 than in 2013 ($p < 0.001$). Considering thermage treatment versus the other procedures, patients receiving the former were less likely to undergo the treatments PDO thread lift ($p < 0.001$, OR = 0.081), Silhouette Soft Thread ($p < 0.001$, OR = 0.063), nasolabial fold filler ($p < 0.001$, OR = 0.049), and botulinum toxin treatment for the masseter ($p < 0.001$, OR = 0.031), and lines of the glabella ($p < 0.001$, OR = 0.206), forehead ($p < 0.001$, OR = 0.309), and lateral canthus ($p < 0.001$, OR = 0.258).

4. Discussion

As age increases, the reduction in skin elasticity due to facial aging creates wrinkles which become more prominent with time. For patients seeking to reduce these wrinkles, surgical facial plastic surgery treatments include brow lifting with an autologous fat transfer, face and neck lifting, laser resurfacing of the skin envelope, and chemical peeling [14].

However, contemporary patients are looking for minimally invasive procedures using, for example, botulinum toxin, filler, and thread lift [7]. In the present study, the data show that the number of patients receiving noninvasive

Table 2. Type and number of patient facial treatments from 2013 to 2017.

		Year					Total n = 4201	p-value
		2013 n = 701	2014 n = 789	2015 n = 776	2016 n = 946	2017 n = 999		
Thermage	X[a]	529	607	521	549	595	2801	p < 0.001
		75.5%	76.9%	67.1%	58.7%	59.6%	66.7%	
	O	172	182	255	387	404	1400	
		24.5%	23.1%	32.9%	41.3%	40.4%	33.3%	
Eye thermage	X	679	761	759	900	963	4062	0.360
		96.9%	96.5%	97.8%	96.2%	96.4%	96.7%	
	O	22	28	17	36	36	139	
		3.1%	3.5%	2.2%	3.8%	3.6%	3.3%	
PDO thread lift	X	642	720	705	888	986	3941	p < 0.001
		91.6%	91.3%	90.9%	94.9%	98.7%	93.8%	
	O	59	69	71	48	13	260	
		8.4%	8.7%	9.1%	5.1%	1.3%	6.2%	
Silhouette soft thread	X	701	781	751	914	956	4103	p < 0.001
		100.0%	99.0%	96.8%	97.6%	95.7%	97.7%	
	O	0	8	25	22	43	98	
		0.0%	1.0%	3.2%	2.4%	4.3%	2.3%	
Nasolabial fold filler	X	611	703	705	847	915	3781	.030
		87.2%	89.1%	90.9%	90.5%	91.6%	90.0%	
	O	90	86	71	89	84	420	
		12.8%	10.9%	9.1%	9.5%	8.4%	10.0%	
Masseter botulinum toxin	X	427	531	536	702	688	2884	p < 0.001
		60.9%	67.3%	69.1%	75.0%	68.9%	68.7%	
	O	274	258	240	234	311	1317	
		39.1%	32.7%	30.9%	25.0%	31.1%	31.3%	
Glabella lines botulinum toxin	X	607	617	620	604	636	3084	p < 0.001
		86.6%	78.2%	79.9%	64.5%	63.7%	73.4%	
	O	94	172	156	332	363	1117	
		13.4%	21.8%	20.1%	35.5%	36.3%	26.6%	
Horizontal forehead lines botulinum toxin	X	622	665	654	671	680	3292	P < 0.001
		88.7%	84.3%	84.3%	71.7%	68.1%	78.4%	
	O	79	124	122	265	319	909	
		11.3%	15.7%	15.7%	28.3%	31.9%	21.6%	
Lateral canthal lines botulinum toxin	X	622	676	687	715	715	3415	p < 0.001
		88.7%	85.7%	88.5%	76.4%	71.6%	81.3%	
	O	79	113	89	221	284	786	
		11.3%	14.3%	11.5%	23.6%	28.4%	18.7%	

X[a], X: untreated case; O: treated case.

Table 3. Type and number of facial treatments by age group from 2013 to 2017.

		Age (years)					Total n = 4201	p-value
		20 - 29 n = 353	30 - 39 n = 1301	40 - 49 n = 1601	50 - 59 n = 758	≥60 n = 188		
Thermage	X[a]	331	890	1011	460	109	2801	p < 0.001
		93.8%	68.4%	63.1%	60.7%	58.0%	66.7%	
	O	22	411	590	298	79	1400	
		6.2%	31.6%	36.9%	39.3%	42.0%	33.3%	
Eye thermage	X	352	1267	1540	721	182	4062	0.001
		99.7%	97.4%	96.2%	95.1%	96.8%	96.7%	
	O	1	34	61	37	6	139	
		.3%	2.6%	3.8%	4.9%	3.2%	3.3%	
PDO thread lift	X	339	1241	1511	684	166	3941	p < 0.001
		96.0%	95.4%	94.4%	90.2%	88.3%	93.8%	
	O	14	60	90	74	22	260	
		4.0%	4.6%	5.6%	9.8%	11.7%	6.2%	
Silhouette soft thread	X	352	1283	1571	717	180	4103	p < 0.001
		99.7%	98.6%	98.1%	94.6%	95.7%	97.7%	
	O	1	18	30	41	8	98	
		.3%	1.4%	1.9%	5.4%	4.3%	2.3%	
Nasolabial fold filler	X	327	1162	1442	682	168	3781	0.479
		92.6%	89.3%	90.1%	90.0%	89.4%	90.0%	
	O	26	139	159	76	20	420	
		7.4%	10.7%	9.9%	10.0%	10.6%	10.0%	
Masseter botulinum toxin	X	93	766	1206	644	175	2884	p < 0.001
		26.3%	58.9%	75.3%	85.0%	93.1%	68.7%	
	O	260	535	395	114	13	1317	
		73.7%	41.1%	24.7%	15.0%	6.9%	31.3%	
Glabella lines botulinum toxin	X	311	1073	1127	472	101	3084	P < 0.001
		88.1%	82.5%	70.4%	62.3%	53.7%	73.4%	
	O	42	228	474	286	87	1117	
		11.9%	17.5%	29.6%	37.7%	46.3%	26.6%	
Horizontal forehead lines botulinum toxin	X	331	1105	1175	554	127	3292	p < 0.001
		93.8%	84.9%	73.4%	73.1%	67.6%	78.4%	
	O	22	196	426	204	61	909	
		6.2%	15.1%	26.6%	26.9%	32.4%	21.6%	
Lateral canthal lines botulinum toxin	X	340	1157	1230	568	120	3415	p < 0.001
		96.3%	88.9%	76.8%	74.9%	63.8%	81.3%	
	O	13	144	371	190	68	786	
		3.7%	11.1%	23.2%	25.1%	36.2%	18.7%	

X[a], X: untreated case; O: treated case.

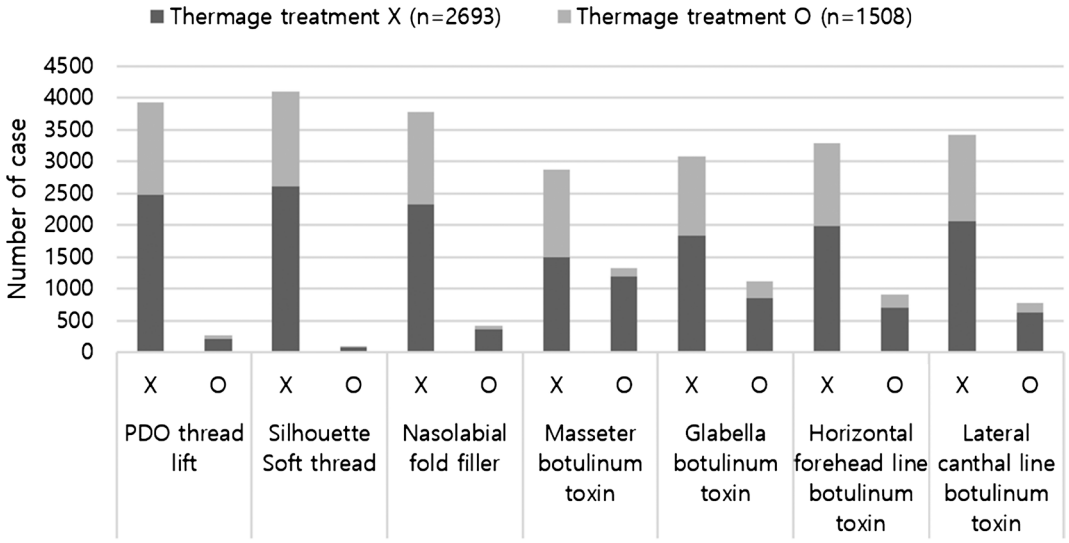

Figure 1. Patient use of minimally invasive and thermage treatments for facial anti-aging management.

Table 4. Results of a logistic regression analysis of the relationship of variables of patient use of facial anti-aging treatments with patient use of two major facial anti-aging treatment classes.

Variables	Adjusted odds ratio	95% C.I.		p-value
		Lower	Upper	
Age (years)				
20 - 29	1			p < 0.001
30 - 39	4.471	2.671	7.483	p < 0.001
40 - 49	5.371	3.222	8.952	p < 0.001
50 - 59	6.921	4.074	11.759	p < 0.001
≥60	7.866	4.221	14.659	p < 0.001
Gender (female)	1.698	1.199	2.405	0.003
Year of treatment				
2013	1			p < 0.001
2014	0.837	0.624	1.122	0.235
2015	1.243	0.931	1.658	0.140
2016	2.738	2.067	3.626	p < 0.001
2017	3.697	2.778	4.920	p < 0.001
PDO thread lift	0.081	0.055	0.118	p < 0.001
Silhouette Soft thread	0.063	0.035	0.112	p < 0.001
Nasolabial fold filler	0.049	0.035	0.068	p < 0.001
Masseter botulinum toxin	0.031	0.025	0.040	p < 0.001
Glabella lines botulinum toxin	0.206	0.165	0.256	p < 0.001
Horizontal forehead lines botulinum toxin	0.309	0.244	0.390	p < 0.001
Lateral canthal lines botulinum toxin	0.258	0.202	0.329	p < 0.001

and minimally invasive treatments in 2017 increased by 42.5% compared to 2013. Patients receiving thermage treatment increased by 134.9% during the 5 years, with the patient group aged 20 - 49 years receiving the most thermage treatments. A previous study in China also reported a striking increase in thermage treatment whereby patients aged 35 - 50 years accounted for the largest population taking advantage of this procedure [1].

The noninvasive RF treatment minimizes the recovery time and risk of postoperative complications that are common with invasive treatment. The RF treatment is performed to treat tissue laxity in the periorbital areas, forehead, and middle and lower face. In previous studies, promising results of nonablative RF treatment to tighten tissue in the periorbital areas were reported. A multicenter study of 86 patients submitted to this treatment demonstrated measurable brow elevation and modest clinical improvement in periorbital rhytids in 80% of the subjects [15]; another study showed improvement of lower eyelid laxity in 9 out of 9 patients [16]. A previous study reported that the middle and lower face laxity of patients who underwent two consecutive noninvasive RF treatment sessions was better than that of those who were treated only once [13]. In addition, previous studies have confirmed the efficacy of thermage treatment in facial aging management when used as a stand-alone treatment or in combination with minimally invasive cosmetic treatments, such as those that use intense pulsed light, nonablative lasers, neurotoxins, and fillers [17] [18] [19] [20]. However, in this study, patients who had received thermage treatment used other minimally invasive treatments less, such as botulinum toxin, filler, and thread lift, than those who had not.

Botulinum toxin injection, which affects muscular activity to correct upper face wrinkles, is most commonly performed clinically [21]. In the present study, results show that as age increases, the rate at which patients receive botulinum toxin treatment also increases. A previous study also found that botulinum toxin injection was the most commonly requested procedure in China, and that age was significantly related to the incidence of its injection [1]. However, in this study, patients who received thermage treatment used less botulinum toxin for the upper face compared to those who did not. This is likely because the group receiving the noninvasive RF treatment has a negative view of more invasive treatments such as botulinum toxin injection.

The nasolabial wrinkles that occur because of aging are a problem for many persons. There are two causes of nasolabial wrinkles: 1) defective muscle and skin defects caused by repeated skin folds, and 2) the downward migration of the malar cheek pads; however, the origin of nasolabial wrinkles in many patients is often mixed [22]. Many patients have considered filler treatment for this condition. In a previous study, patients who received filler reported no effect on nasal folding, whereas those that had the thermage treatment indicated a positive effect [23]. In this study, the patients who underwent thermage treatment had less nasolabial fold filler treatment. This result could be interpreted to the effect that

the patients who received the thermage treatment rejected the filler treatment because it involves the invasive insertion of foreign material into the skin. A nasolabial crease is common in thin skin, and an analysis should be carried out of whether the nasolabial fold filler procedure has less of an effect on the improvement of the nasolabial crease than the thermage treatment does.

Signs of aging in the lower face are manifested as a poor definition of the mandibular margin as the facial soft tissue shifts downward due to gravity. The PDO short suture thread treatment creates a skin meshwork over the marionette line and the SMAS plane to improve the skin-tightening and rejuvenation of the lower facial area including the jawline. The Silhouette Soft Thread treatment improved the marionette line and the jawline by using the long suture technique to trap the exit point toward the insert point and the marionette line from the hairline side [24]. In a clinical study, patients who had received a minimally-invasive cosmetic procedure for their sagging jowl reported no effect; in contrast, they reported that thermage treatment was successful for this problem. These same patients, in general, had good-quality skin despite early aging, and expressed that persons who do not want an operative procedure might be satisfied with thermage tissue tightening [23]. The present study found that patients who had received thermage treatment had received fewer treatments with thread lift ($P < 0.001$). This result can be interpreted as reflecting the tendency of patients to receive thermage treatment instead of a relatively invasive treatment.

The limitation of this study is that causal relationships between variables cannot be identified because of the particular characteristics of the retrospective study and because there was no time series analysis on the different procedures. Future studies should analyze whether the noninvasive RF treatment improves the "skin-to-time relationship" in relation to other treatments, and, due to its superior skin improvement capability, whether it reduces the need for treatments involving botulinum toxin, filler, or thread lift. Nonetheless, this study is important since it supports the recent facial anti-aging trend in which facial treatments have moved from invasive to minimally invasive and noninvasive.

5. Conclusion

This study provides evidence that patients who undergo noninvasive RF treatment are less inclined to use botulinum toxin, filler, and thread lift procedures. These results suggest that noninvasive RF treatment is increasingly being selected by patients because of their increased rejection of invasive treatments based on their perception that they can be painful and produce side effects, especially the common botulinum toxin, filler, and thread lift procedures.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Li, J., Li, Q., Zhou, B., Gao, Y., Ma, J. and Li, J. (2016) Predictive Factors for Cosmetic Surgery: A Hospital-Based Investigation. *SpringerPlus*, **5**, 1543. https://doi.org/10.1186/s40064-016-3188-z

[2] Tam, K.P., Ng, H.K., Kim, Y.H., Yeung, V.W. and Cheung, F.Y. (2012) Attitudes toward Cosmetic Surgery Patients: The Role of Culture and Social Contact. *The Journal of Social Psychology*, **152**, 458-479. https://doi.org/10.1080/00224545.2011.637997

[3] Sarwer, D.B., Cash, T.F., Magee, L., Williams, E.F., Thompson, J.K., Roehrig, M., *et al.* (2005) Female College Students and Cosmetic Surgery: An Investigation of Experiences, Attitudes, and Body Image. *Plastic and Reconstructive Surgery*, **115**, 931-938. https://doi.org/10.1097/01.PRS.0000153204.37065.D3

[4] von Soest, T., Kvalem, I.L., Skolleborg, K.C. and Roald, H.E. (2006) Psychosocial Factors Predicting the Motivation to Undergo Cosmetic Surgery. *Plastic and Reconstructive Surgery*, **117**, 51-62.

[5] Sharp, G., Tiggemann, M. and Mattiske, J. (2014) The Role of Media and Peer Influences in Australian Women's Attitudes towards Cosmetic Surgery. *Body Image*, **11**, 482-487. https://doi.org/10.1016/j.bodyim.2014.07.009

[6] Kim, Y.J., Park, J.W., Kim, J.M., Park, S.H., Hwang, J.H., Kim, K.S., *et al.* (2013) The Functionality of Facial Appearance and Its Importance to a Korean Population. *Archives of Plastic Surgery*, **40**, 715-720. https://doi.org/10.5999/aps.2013.40.6.715

[7] Chuang, J., Barnes, C. and Wong, B.J.F. (2016) Overview of Facial Plastic Surgery and Current Developments. *The Surgery Journal*, **2**, e17-e28. https://doi.org/10.1055/s-0036-1572360

[8] Jacono, A.A. and Rousso, J.J. (2013) The Modern Minimally Invasive Face Lift: Has It Replaced the Traditional Access Approach? *Facial Plastic Surgery Clinics*, **21**, 171-189.

[9] Choe, W., Kim, H., Han, B. and Kim, J. (2017) Thread Lifting: A Minimally Invasive Surgical Technique for Long-Standing Facial Paralysis. *HNO*, **65**, 910-915. https://doi.org/10.1007/s00106-017-0367-3

[10] Brin, M.F., Boodhoo, T.I., Pogoda, J.M., James, L.M., Demos, G., Terashima, Y., *et al.* (2009) Safety and Tolerability of onabotulinumtoxinA in the Treatment of Facial Lines: A Meta-Analysis of Individual Patient Data from Global Clinical Registration Studies in 1678 Participants. *Journal of the American Academy of Dermatology*, **61**, 961-970. https://doi.org/10.1016/j.jaad.2009.06.040

[11] Naumann, M. and Jankovic, J. (2004) Safety of Botulinum Toxin Type A: A Systematic Review and Meta-Analysis. *Current Medical Research and Opinion*, **20**, 981-990. https://doi.org/10.1185/030079904125003962

[12] Duncan, D.I. and Kreindel, M. (2015) Basic Radiofrequency: Physics and Safety and Application to Aesthetic Medicine. In: Lapidoth, M. and Halachmi, S., Eds., *Radiofrequency in Cosmetic Dermatology*, Karger Publishers, Basel, 1-22.

[13] Abraham, M.T. and Mashkevich, G. (2007) Monopolar Radiofrequency Skin Tightening. *Facial Plastic Surgery Clinics of North America*, **15**, 169-177. https://doi.org/10.1016/j.fsc.2007.01.005

[14] Wu, W. (2007) Non Surgical Facial Rejuvenation with the 4R Principle: Innovative Uses of BOTOX and the Woffles Lift. Springer, Berlin, 636-649.

[15] Fitzpatrick, R., Geronemus, R., Goldberg, D., Kaminer, M., Kilmer, S. and Ruiz-Esparza, J. (2003) Multicenter Study of Noninvasive Radiofrequency for Pe-

riorbital Tissue Tightening. *Lasers in Surgery Medicine*, **33**, 232-242. https://doi.org/10.1002/lsm.10225

[16] Ruiz-Esparza, J. (2004) Noninvasive Lower Eyelid Blepharoplasty: A New Technique Using Nonablative Radiofrequency on Periorbital Skin. *Dermatologic Surgery*, **30**, 125-129. https://doi.org/10.1097/00042728-200402000-00001

[17] Taub, A.F. and Devita, E.C. (2008) Successful Treatment of Erythematotelangiectatic Rosacea with Pulsed Light and Radiofrequency. *The Journal of Clinical and Aesthetic Dermatology*, **1**, 37-40.

[18] Cameli, N., Mariano, M., Serio, M. and Ardigo, M. (2014) Preliminary Comparison of Fractional Laser with Fractional Laser plus Radiofrequency for the Treatment of Acne Scars and Photoaging. *Dermatologic Surgery*, **40**, 553-561. https://doi.org/10.1111/dsu.12470

[19] Taub, A.F. and Garretson, C.B. (2011) Treatment of Acne Scars of Skin Types II to V by Sublative Fractional Bipolar Radiofrequency and Bipolar Radiofrequency Combined with Diode Laser. *The Journal of Clinical and Aesthetic Dermatology*, **4**, 18-27.

[20] Peterson, J.D., Palm, M.D., Kiripolsky, M.G., Guiha, I.C. and Goldman, M.P. (2011) Evaluation of the Effect of Fractional Laser with Radiofrequency and Fractionated Radiofrequency on the Improvement of Acne Scars. *Dermatologic Surgery*, **37**, 1260-1267. https://doi.org/10.1111/j.1524-4725.2011.02110.x

[21] Fritz, M., Counters, J.T. and Zelickson, B.D. (2004) Radiofrequency Treatment for Middle and Lower Face Laxity. *Archives of Facial Plastic Surgery*, **6**, 370-373. https://doi.org/10.1001/archfaci.6.6.370

[22] Rubin, M.G. (2004) Treatment of Nasolabial Folds with Fillers. *Aesthetic Surgery Journal*, **24**, 489-493. https://doi.org/10.1016/j.asj.2004.06.004

[23] Hodgkinson, D.J. (2009) Clinical Applications of Radiofrequency: Nonsurgical Skin Tightening (Thermage). *Clinics in Plastic Surgery*, **36**, 261-268. https://doi.org/10.1016/j.cps.2008.11.006

[24] Yongtrakul, P., Sirithanabadeekul, P. and Siriphan, P. (2016) Thread Lift: Classification, Technique, and How to Approach to the Patient. World Academy of Science, Engineering and Technology. *International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering*, **10**, 547-555.