

Chapter 2

Treatment of Neck Laxity with Radiofrequency and Infrared Light

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Introduction

Neck rejuvenation predominantly targets skin laxity, with a lesser emphasis on rhytides and photoaging. Neck laxity may increase with age due to progressive prominence of platysmal bands, loss of bony mass along the mandible and mental region, increased subcutaneous fat, and loosening of the connective tissue framework. Additionally, photoaging may result in progressive solar elastosis, which may contribute to rhytides, laxity, and poor texture. Important limitations to treatment include the anterior location of the thyroid and parathyroid glands, which must be shielded from deeply penetrating wavelengths. The increased scarring risk on chest secondary to pulsed light indicates a potential increased scarring risk on the inferior aspect of the neck as compared to face, thus necessitating greater care and lower fluences in this region. Overall, neck rejuvenation targets skin laxity bringing skin tightening technologies to the forefront in this category.

Clinical Examination and Patient History

The classification of neck laxity, rhytides, and photoaging into quantitative grades has been previously published and evaluated in clinical trials of laser and light-based treatments of laxity and rhytides (Table 2.1). A patient presenting with a grading score of two or higher may experience less utility from treatment of neck laxity with radiofrequency and infrared light. Patients aged over 65 are less likely to respond to radiofrequency treatment for reasons that remain to be elucidated and therefore, should be strongly discouraged from this form of treatment. Patients with a history of thyroid or parathyroid disease or neoplasia are

contraindicated. In addition, patients with rheumatologic or connective tissue diseases, such as fibromyalgia rheumatica, lupus erythematosus, scleroderma, dermatomyositis, or other autoimmune skin diseases, are also contraindicated. Baseline and follow-up photography from both sides is exceedingly important, as the degree of improvement in neck laxity is often best appreciated by side views. It is recommended that the baseline and first set of follow-up photographs be reviewed with the patient if the level of efficacy is in question. Patients are cautioned that in the vast majority of cases, a minimum of three treatments are required to achieve significant tightening, though some patients opt to pursue as many as five treatment sessions. Managing patient expectations at the outset are very important: it is best to explicitly elicit from the patient that they have ruled out the option of a neck lift and are willing to invest the time, effort, and funds toward three tightening sessions before determining whether the treatment was a success. The level of patient satisfaction has varied depending on the technology and protocol used between 30 and 70%.

Method of Device or Treatment Application

Radiofrequency

Dose/Settings

1. *Monopolar RF (Thermage, ThermoCool system, Solta Medical Inc., Hayward, CA)*: The manufacturer suggests avoiding the use of topical anesthetics whenever possible, as it may mask discomfort and

Table 2.1 Quantitative grading and classification system of laxity, rhytides, and photoaging

Grading Scale	Descriptive parameter	Categories of skin aging and photodamage							Patient satisfaction (Y/N)	
		Rhytides	Laxity	Elastosis	Dyschromia	Erythema-Telangiectasia (E-T)	Keratoses	Texture		Overall score
0	None	None	None	None	None	None	None	None	None	
1	Mild	Wrinkles in motion, few, superficial	Localized to nasolabial (nl) folds	Early, minimal yellow hue	Few (1-3) discrete small (<5 mm) lentigines	Pink E or few T, localized to single site	Few	Subtle irregularity		
1.5	Mild	Wrinkles in motion, multiple, superficial	Localized, nl and early melolabial (ml) folds	Yellow hue or early, localized periorbital (po) elastotic beads (eb)	Several (3-6), discrete small lentigines	Pink E or several T localized to two sites	Several	Mild irregularity in few areas		
2	Moderate	Wrinkles at rest, few, localized, superficial	Localized, n/ml folds, early submental/submandibular (sm)	Yellow hue, localized po eb	Multiple (7-10), small lentigines	Red E or multiple T localized to two sites	Multiple, small	Rough in few, localized sites		
2.5	Moderate	Wrinkles at rest, multiple, localized, superficial	Localized, prominent n/ml folds, jowls and sm	Yellow hue, po and malar eb	Multiple, small and few large lentigines	Red E or multiple T, localized to three sites	Multiple, large	Rough in several, localized areas		
3	Advanced	Wrinkles at rest, multiple, forehead, periorbital and perioral sites, superficial	Prominent n/ml folds, jowls and sm, early neck strands	Yellow hue, eb involving po, malar and other sites	Many (10-20) small and large lentigines	Violaceous E or many T, multiple sites	Many	Rough in multiple, localized sites		
3.5	Advanced	Wrinkles at rest, multiple, generalized, superficial; few, deep	Deep n/ml folds, prominent jowls and sm, prominent neck strands	Deep yellow hue, extensive eb with little uninvolved skin	Numerous (>20) or multiple large with little uninvolved skin	Violaceous E, numerous T little uninvolved skin	Little uninvolved skin	Mostly rough, little uninvolved skin		
4	Severe	Wrinkles throughout, numerous, extensively distributed, deep	Marked n/ml folds, jowls and sm, neck redundancy and strands	Deep yellow hue, eb throughout, comedones	Numerous, extensive, no uninvolved skin	Deep, violaceous E, numerous T throughout	No uninvolved skin	Rough throughout		

result in local adverse events. However, for patient comfort, some practitioners do use topical anesthetics in concert with a safe low energy multi-pass treatment approach. Moisten skin with alcohol. Apply the 3.0-cm² skin marking paper to the neck. Dab with alcohol then remove the marking paper. Commence initial treatment level at 362.0 for the 3.0-cm² ThermoTip TC. Apply coupling fluid and deliver application of energy to assess pain tolerance. Titrate the setting based on patient's heat sensation feedback. Continue to titrate setting until patient reports heat sensation feedback of 2–2.5 based on a 0–4 point scale. Current recommendations are to perform several (4–6) passes at lower settings (352.0–354.0) within each treatment area before treating the next area. See Fig. 2.1 for photographic example of reduction of neck laxity with monopolar RF (Table 2.2).

2. *Bipolar RF combined with diode (900 nm) laser (Polaris and Galaxy, Syneron Inc.):* Anesthesia in the form of topical EMLA is applied for 1 h. No grounding pad is necessary. Aqueous gel is applied in a thin 2–3 mm layer. For neck, commence the RF fluence at 80 J/cm². Increase by 10 J/cm² as tolerated to 100 J/cm² maximum. For the initial treatment, employ moderate laser fluence, commencing at 20–22 J/cm² and increasing by 2–4 J/cm² per treatment session to a maximum of 36 J/cm² in type I skin. Multiple passes of 6–10 are administered with each treatment session. The clinical endpoint is diffuse erythema and immediate tightening. Key pearls during treatment include maintaining good contact with adequate aqueous gel to avoid arcing, and not stacking pulses to avoid ischemia.
3. *Bipolar RF (ST ReFirme, Syneron Inc.):* No topical anesthetic is necessary. Aqueous gel is applied in a

Monopolar RF (Thermage)



Courtesy Tina Alster MD

Fig. 2.1 Treatment zones of the neck for radiofrequency protocols

Table 2.2 Treatment protocols of neck laxity with radiofrequency technologies. All technologies should be applied to submental, submandibular, and lateral neck regions, strictly avoiding thyroid region

Device	Fluence J/cm ²	Pulses/Passes	Target temp (Celsius)	Rx # interval
Monopolar (thermage 3.0 cm ² tip, Solta Medical Inc.)	20–162 (352–364 treatment level)	4–6 passes	NA	3–5 q month
Bipolar with diode 900 nm laser (Polaris and Galaxy, Syneron Inc.)	90–100	6–10 passes	NA	3–5 q month
Bipolar with Infrared light (ST ReFirme, Syneron Inc.)	100–120	200 pulses per target zone	39	3–6 q 1–4 wk
Bipolar (Accent, Alma)	70, 60, 50, 40	1-3,1,1,1 (30-s) passes	40–43	3–5 q 1–4 wk
Unipolar (Accent, Alma)	90, 80, 70, 60	1-3,1,1,1 (30-s) passes	40–43	3–5 q 1–4 wk

2–3 mm film. RF fluence should be commenced at 100 J/cm² increasing to 120 J/cm² as tolerated at normal cooling. Apply a series of pulses numbering 100–250 to each treatment zone, commencing with each temporomandibular junction, followed by the lateral submandibular and upper neck region, and the submental region. If an infrared thermometer is employed, a peak temperature of 40°C is the desired endpoint. A total of 750–1,000 pulses should be administered to the neck.

4. *Unipolar and Bipolar RF (Accent, Alma)*: No topical anesthetic is necessary. Mineral oil is applied to the skin. All passes with the unipolar followed by bipolar handpiece should be administered to one side of the neck followed by the other, avoiding the thyroid region. Unipolar RF is applied first with a starting fluence of 90–100 J/cm² for 1–2 20-second passes. Once a target temperature of 40°C is achieved, three maintenance passes should be delivered at decrements of 10 J/cm² per pass. Bipolar RF is then administered with a starting fluence of 68–70 J/cm² for 1–2 20-second passes followed by three maintenance passes at decrements of 10 J/cm². Treatments may be administered weekly to monthly, totaling 3–5 treatment sessions. The key pearls include applying adequate mineral oil so that the handpiece is kept mobile and applied in a circular fashion, while avoiding the large superficial and vascular structures of the

carotid system, which are present at the far lateral edges of the anterior neck. Figure 2.2 demonstrates the degree of efficacy of unipolar and bipolar RF on reduction of neck laxity, which is notable immediately postoperatively.

Postoperative Care

None of the skin tightening technologies require postoperative care. Postoperative erythema is expected and typically dissipates over minutes to hours.

Management of Adverse Events

In the case of monopolar radiofrequency, rare cases of superficial burns, erythematous nodules, and atrophy have been reported. Nodules are best treated with intralesional corticosteroids. Superficial burns are treated with topical silver sulfadiazine (e.g., Silvadene) or other wound dressing protocols. With the bipolar RF device Polaris, vascular necrosis is possible if pulses are stacked and crusting is produced by inadvertent arcing of the device if inadequate contact is made. These should be treated with silvadene or other wound care protocols. Rarely, superficial crusting may be observed with the ST as well. No adverse events were

Laser Skin Tightening *Unipolar and Bipolar RF*

Pre



Immediately Post 1 Rx



From M. Alexiades-Armenakas MD PhD

Fig. 2.2 Degree of efficacy of unipolar and bipolar RF on reduction of neck laxity, which is notable immediately postoperatively

observed during the author's experience with the Accent device, though the handpiece was kept mobile to avoid potential burns.

Infrared Wavelengths

Infrared Light (1,100–1,800 nm, Titan, Cutera)

1. *Dose/Settings:* No topical anesthetic is needed for the procedure. A thin 1-mm layer of cold 4°C aqueous ultrasound gel is applied. The treatment area on the neck is confined to midway up the neck to the mandible, excluding the thyroid region. Energy may be delivered in a stationary manner, applying adjacent pulses without moving the handpiece, or in a mobile manner, making circular movements. The fluence is commenced at 32 J/cm² for the stationary protocol and 40 J/cm² for the mobile protocol and titrated as tolerated to a maximum of 36 J/cm² for the majority of stationary pulses and 44 J/cm² for mobile administration, while adjusting based on patient comfort (range: 30–36 J/cm² stationary; 40–44 J/cm² mobile). Three passes of adjacent nonoverlapping pulses are administered, each covering an area of 1.5 cm². The clinical endpoints are warmth but no discomfort following the first pass, followed by pain tolerance to the end of the second “vector” or focused pass that is applied to a targeted region. The pulses over bony areas (e.g., mandible) should be administered with a reduced fluence of 30–32 J/cm². The target number of pulses applied to the anterior neck should number 100 following a total of two passes. Pre-, parallel, and post-cooling of the epidermis is applied to under 40°C through continuous contact with a sapphire tip.
2. *Treatment technique:* A minimum of two passes are required in order to achieve demonstrable results and three passes are typically recommended. The pulses should be administered in a linear fashion along the jawline, along the upper neck and in the submental area. Three passes are administered in succession to each linear area before commencing in a new area. A total of 3 monthly treatment sessions are recommended. Figure 2.3 demonstrates reduction of laxity and rhytides on the anterior neck through application of passes to the lateral and submental regions.
3. *Postoperative Care:* Postoperative erythema resolves within minutes to hours and no postoperative care is needed.
4. *Management of Adverse Events:* Vesiculation or blistering have been reported infrequent complications. During the procedure, this may be averted by utilizing the mobile technique and discontinuing administration of a pulse when discomfort is heightened. Wound care such as topical silvadene cream should be applied to facilitate healing. Post-

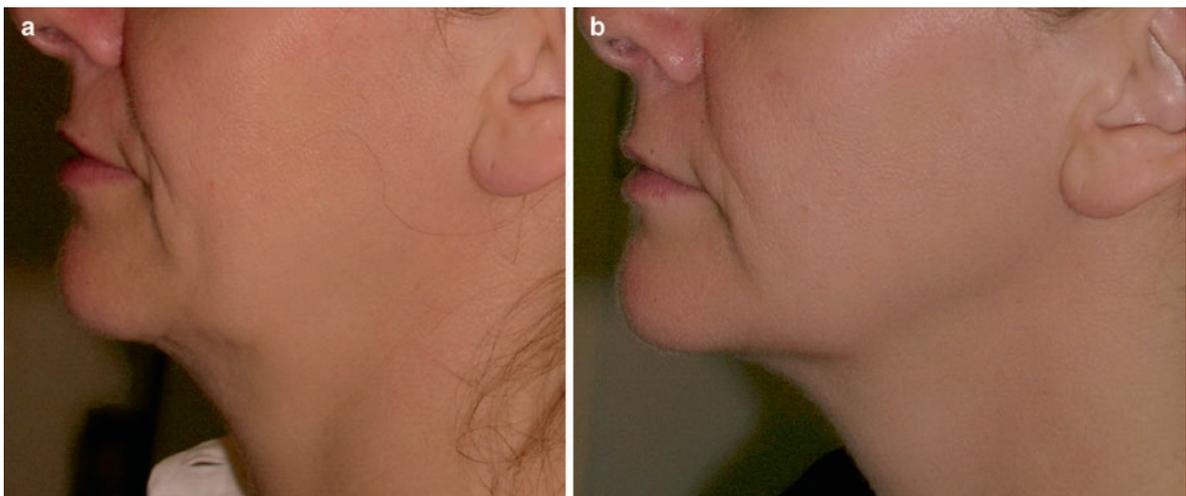


Fig. 2.3 Treatment of neck laxity with a broadband 1,100–1,800 nm infrared device. Patient prior to treatment (a) and 1 month following two treatments (b)

inflammatory hyperpigmentation may be observed following healing which gradually fades.

1,310 nm Diode Laser (Candela)

1. *Dose/Settings:* No anesthesia is required for this device. Aqueous ultrasound gel is applied in a thin 1–2 mm film. The variable depth device allows for targeting of different depths (Table 2.3).
2. *Treatment Technique:* A total of three passes are administered in succession. Pressure needs to be applied when delivering the pulses to the submandibular region in order to maintain good contact. The aqueous gel should be removed for the superficial targeting pass. The different depth targeting parameters may be combined in a single treatment, delivering one pass at deep, one pass at a medium depth setting, and a final pass at the superficial setting. Power may be titrated upward as tolerated, not to exceed 30 W. In Fig. 2.4, the mandibular defini-

tion is improved with a reduction of joweling and mandibular laxity following three treatments with the 1,310 nm laser to the lower face and neck.

3. *Postoperative Care:* Minimal erythema lasting several minutes to one hour is expected. No postoperative care is required.
4. *Management of Adverse Events:* In clinical trials, rare instances of superficial burns were reported, which healed with silver sulfadiazine cream topically twice daily.

Minimally-Invasive Radiofrequency (Miratone System, Primaeva Medical, Inc., Pleasanton, CA)

1. *Dose/Settings:* Prior to treatment, the patient's skin was cleansed with Betadine® and treatments were delivered medial to lateral in rows following anatomical margins. Topical (EMLA) and/or local anesthesia with dilute lidocaine (¼ % with 1:400,000 epinephrine) is administered. A local anesthetic

Table 2.3 Variable depth 1310 nm laser parameters for treatment of facial and neck laxity

Targeting	Spot size (mm)	Starting power (W)	Precool (s)	Laser pulse duration (s)	Postcool (s)	Cooling temp
Deep Dermis	12	24	1	1	1–3	2°C
Mid Dermis I	18	24	1	3	1	2°C
Mid Dermis II	18	17	1	5	1	2°C
Superficial Dermis	18	20	0.1	1	0.1	No cooling

1310nm laser Candela



Fig. 2.4 Treatment of neck laxity with a variable depth heating 1,310 nm laser. A patient prior to (a) and at 1 month (b), 3 months (c), and 6 months (d) following 3 monthly treatments. Note the progressive improvement in facial and neck laxity from 1 to 6 months follow-up

quantity of 18 cc of ¼ % lidocaine is used to infiltrate both cheeks, submental and lateral neck regions per patient. Fractional radiofrequency (FRF) energy is delivered through five micro-needle electrode pairs deployed into the reticular dermis at an angle of 20° to the skin surface with the exposed electrode length extending from 0.75 to 2 mm below the skin surface. The intra-dermal location of the electrode tips is determined by real-time impedance measurements, such that impedance measurements of between 300 and 2000 Ohms are used to define ideal intra-dermal placement. Software built into the device preclude energy delivery if impedance between an electrode pair measured below 300 or over 3000 Ohms, thereby restricting energy delivery to proper intra-dermally placed electrodes. Software is programmed to deliver energy until a pre-selected intradermal target temperature is attained, and for a specified duration in seconds.

2. *Treatment Technique:* Conservative treatment parameters of 62°C and 3 seconds may be selected for initial cases. More aggressive treatment parameters of 68-75°C and 5 seconds may be selected. Epidermal cooling is achieved by positioning a cooling device maintained at a temperature of 15°C, directly on the skin surface above the exposed electrode length. The spacing of the bipolar needle pairs and the spacing of successive applications of the device are selected to give 15% to 35% fractional skin coverage by surface projection.
3. *Post-operative Care:* The patient's skin is cleansed with normal saline, and a thin coat of white petrolatum is applied. Patients are allowed to resume normal activities immediately, and instructed to wash the skin with mild cleansers, to avoid makeup for 24 hours, and to minimize sun exposure for 14 days.
4. *Management of Adverse Events:* Superficial placement of electrodes may result in superficial thermal burns and pinpoint scar-formation in rare instances. Application of silver sulfadiazidine cream twice daily topically will facilitate healing.

Conclusion

Radiofrequency therapy applied to the skin is limited by penetration depth and protection of epidermis from thermal injury by surface cooling. Infrared lasers provide the option of variable depth targeting, which will require further investigation to determine the optimal depth or range of depths needed in order to achieve demonstrable tightening. It is not possible to definitively distinguish between these tightening modalities regarding degree of treatment efficacy. The impact of differences in treatment parameters and patient-specific anatomic features can outweigh the impact of mechanical differences across devices. Overall, efficiency may vary from 0 to approaching 50% improvement in skin laxity.

Most recently, a minimally-invasive fractional radiofrequency device completed FDA trials and has been FDA-approved for the treatment of rhytides. Efficacy rates determined by blinded, randomized grading using the validated laxity grading scale demonstrated higher efficacy rates than skin surface technologies.

Future aims include improving the degree of contracture and degree of accuracy of targeting to various depths of the tissue. It will be determined whether different penetration depths are needed for different body sites and tissues. Newer devices are being developed, which will greatly improve the level of targeting and temperature regulation at these depths.



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