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A.S.A.P. - The first algorithm to treat keloids and hypertrophic scars

A.S.A.P. - O primeiro algoritmo para tratar queloides e cicatrizes hipertróficas

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ABSTRACT

Keloids (K) and hypertrophic scars (HS) are highly prevalent, but their treatment is still challenging. Several treatments are beneficial to treat K/HS, but there is still no protocol or algorithm to address scars following an organized step-by-step and justifying each type of treatment in the scar phases. This study aims to present an algorithm to treat keloids/scars. It has been used for several years in our clinic and helps organize several therapies to treat scars. Combined, these sequences of treatments lead to progressive improvement in K and HS.

Keywords: Acne keloid; Hypertrophic scar; Keloid.

RESUMO

Queloides e cicatrizes hipertróficas são muito prevalentes, mas seu tratamento ainda é desafiador. Vários tratamentos se mostraram benéficos, mas ainda não há um protocolo ou algoritmo para abordar cicatrizes, que siga um passo-a-passo organizado e que justifique o uso de cada tipo de tratamento em uma fase da cicatriz. O objetivo deste estudo é apresentar uma proposta de algoritmo para tratar cicatrizes, usado em nosso serviço por alguns anos. Ele ajuda a organizar as diversas terapias empregadas no tratamento de cicatrizes. Combinadas, estas sequências de tratamentos levam a uma melhora progressiva em queloides e cicatrizes hipertróficas.

Palavras-chave: Acne queloide; Cicatriz; Cicatriz hipertrófica; Queloides.

How do I do it?

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INTRODUCTION

Keloids (K) and hypertrophic scars (HS) are highly prevalent. However, their treatment is still significantly challenging.¹ Symptoms such as itch and pain, and aesthetic and psychological complaints negatively interfere with affected individuals' health-related quality of life (HRQL) and burden of keloid disease.^{1,2} Surgery frequently leads to recurrence,^{1,2} and the bad outcome can be interpreted as malpractice in litigation, which is always a concern among plastic surgeons and dermatologists.³

During a prospective randomized study to investigate the effectiveness of silicone dressings to treat scars due to an anti-scarring silicone effect, or occlusion, we employed silicone or hydrocolloid sheets on a group of K/HS, and we observed that both dressings were successful in decreasing K/HS physical and subjective parameters. We also observed that the injection of triamcinolone in previously softened lesions was less painful, and the drug could diffuse throughout the whole lesion.⁴ On our outpatient clinic focused on K/HS treatment, we later found out that after using this "softening" procedure for several weeks, fewer injections of steroids were sufficient to treat large lesions that previously would require more sessions.⁵ We have later incorporated technologies such as Intense Pulsed Light (IPL), which made the injections even easier, motivating us to write a protocol to treat scars.⁵ Also, the increased number of patients with atrophic scars after steroid injections on K/HS referred to our ambulatory became part of our incentive; we observed that following the guidelines of our protocol could avoid scar atrophy, which also leads to patient dissatisfaction.

The objective of this manuscript is to share a simple algorithm to treat K and HS. The A.S.A.P algorithm discusses the rationale to combine four sequential steps, leading to a progressive improvement in K/HS.

Algorithm step 1. A – Assessment: analyze carefully before any treatments (A.S.A.P)

Patients that come to their first appointment to the keloids and scars outpatient clinic can be separated into four groups of scars:

- 1) K/HS, without previous treatments;
- 2) Post-burn or post-traumatic scars, referred to our facility after hospital discharge;
- 3) Recurrent keloids, after previous therapies; usually treated with surgery, cryotherapy, or steroid injections;
- 4) Atrophic scars, after the complete resolution of a previous K/HS, due to corticosteroid injections.

This last subset of patients is usually as dissatisfied as patients of the three other groups. Although previous K or HS improved after receiving multiple triamcinolone injections, or even occlusive steroids impregnated tapes for long periods, these scars evolved into depressed, achromic, teleangiectatic lesions.

Steroid injections are popular among dermatologists and plastic surgeons due to the apparent ease of the technique and the possibility to be performed during the first appointment as an in-office procedure. Thus, they are usually chosen as the first approach to K/HS. While litigation and lawsuits involving cosmetic surgery are a growing concern, verifying the real need for drug administration or a medical procedure is an essential step to avoid iatrogenesis.³

The first algorithm phase ("A" – assessment) requires the physician to classify the scar to be treated, and analyze the best approach for each one of these lesions (Table 1). Steroids should not be used as a first method to treat hypertrophic scars, as natural subsequent atrophy might follow, and steroids could maximize the outcome. Keloids may need steroids injections at some point, but they may respond better to injections after softening by occlusive dressings – the next algorithm (Step "S" – Figure 1). Large lesions such as pedunculated earlobe keloids may be referred for surgery plus radiotherapy, or intralesional cryotherapy, with further follow-up and eventual referral to algorithm Steps 2, 3, and 4 to avoid keloid recurrence (Table 1). Retractable scars may also benefit from surgery in the beginning, although some may be treated with noninvasive methods⁵ (Figure 2. A and B).




Histamine H1 blockers are anti-inflammatory and antiproliferative drugs that relieve pain and itching sensations on keloids and hypertrophic scars. They inhibit the deposition of collagen by a mechanism of TGF-beta suppression.⁶ Oral antihistaminic drugs are given on this first treatment phase to relieve symptoms of very itchy scars. Therefore, Step A – "Analyze before any treatments" is the first algorithm stage (Figure 1, A, C, Figure 3, Table 1).

Algorithm step 2. S - Soften the scar before injections (A.S.A.P)

Steroids and anti-neoplastic injections are worldwide accepted methods to treat K and HS. However, their use on keloids with substantial stiffness can be challenging, causing significant patient discomfort and pain. We have previously described that occlusive dressings can help soften the scars before the injections, decreasing pain and allowing lower steroid doses to diffuse better on the fibrotic tissue⁴ (Figure 1, A, B, Video 1).

Occlusive silicone and hydrocolloid dressings lead to a comparable decrease in volume, symptoms, and erythema, finally softening the K/HS.⁴ Scars treated with both dressings improve Vancouver Scar Scale parameters and reduce intra-scar pressure, facilitating intralesional triamcinolone (TA) injections.⁴ Hydrocolloids are self-adhering and chosen to treat body regions that have greater mobility, such as eyelids and hands.⁵ Silicone and non-silicone dressings are covered with microporous tape and can be changed each 7-15 days.^{4,5} After 2-4 months, a significant improvement in pain/itching and scar pliability are observed, and injections are easily performed in

TABLE 1: Clinical evaluation and management**PROTOCOL STEP 1. A** - Analyze the scar that will be treated | Requires scar classification

	<p>HYPERTROPHIC SCAR Respects de limits of the original scar Area not particularly prone to the formation of keloids May improve overtime</p>	DO NOT use steroids (may cause atrophy)
	<p>KELOID It grows beyond the limits of the original scar Significant stiffness may difficult scar injections</p>	Follow to next Protocol Step 2- S Softening the keloid will allow for easier injections
	<p>PEDUNCULATED KELOIDS It grows continuously It will not improve without treatment</p>	Therapeutic approaches: Surgery plus radiotherapy and follow to Protocol Step 2 Protocol Steps 2-3 (some lesions may improve) Intralesional Cryotherapy followed by Protocol Step 2

PROTOCOL STEP 2. S - Soften the scar or keloid to prepare them for future injections

SILICONE DRESSING	Comes in different forms and sizes Stripes, sheets	Must cover the whole K/HS It needs to be fixed on skin by microporous medical tape. After each 7 days, remove, rinse skin and silicone sheet. Can be reused for 1-4 months
NON-SILICONE DRESSINGS		Must be replaced each 7 days
PRESSURE GARMENTS	Can be manufactured to suit patient's needs	Earrings, elastic garments

PROTOCOL STEP 3. A

Approach the keloid or scar with lasers and injections

Triamcinolone hexacetonide (TH)	Monthly injections	Very small volumes, 0,1-0,3 ml total dose
5-FU	1:1 or 9:1 combinations with TH	
Bleomycine	1:1 combination with TH	
IPL	Applied immediately prior to the injections, may lead to transient edema that facilitates injections	

PROTOCOL STEP 4. P

It is easier to treat pigmentation and improve the quality of the skin/scar after hypertrophy has resolved

Retinoic acid, glycolic acid, hydroquinone – help prepare scar before peels and lasers

Peelings- Retinoic acid- several sessions

8-MOP- Topical, and sun exposure- Improve achromic scars

Microneedling- Improve achromic scars and the quality of the skin

Fractional and non-fractional laser- help organize scar collagen and improve the quality of the skin

Fat grafts- may help the resulting scar/skin quality and help decrease uneven scars

softer scars^{4,5} (Video 1). Occlusive dressings and pressure garments may lead to a satisfactory outcome even without injections and technologies.

Pressure garments (PG) are a worldwide accepted method to treat K/HS⁶ and they are also employed in this phase. Garments' correct use is mandatory to exert their effects; they should contact the whole scar for several hours/day, and promote blanching.⁷ PG helps dressings stay in place and protects the scar from sun exposure. We customize handcrafted garment devices using elastic and inelastic fabrics combined in different models to suit patients' needs.⁴ Most HS become flat solely by the dressings and PG, as well as small K. An adverse event commonly observed in this phase is "miliaria", due to the long periods of occlusion. We advise patients to remove the dressings and garments for two days, rinsing the affected skin several times. It is important to mention that pain and itching significantly decrease during algorithm stage "S".^{4,5} Patients who present complete flattening do not need to go through the next algorithm step ("A"), but can follow to the last algorithm phase ("P") (Figure 3).

Algorithm step 2 "S" can be achieved after 1-4 months of occlusive (silicone and non-silicone) dressings and pressure garments.

Algorithm step 3. A - Approach with injections and technologies (A.S.A.P.)

Once the K/HS is softened, it becomes prone to receive less painful injections with a better drug diffusion into the scar tissue⁴ (Figure 1, B). Triamcinolone acetonide (TA) is the preferred intralesional drug to treat HS/K. However, it has been discontinued in Brazil, where triamcinolone hexacetonide (TH) is now used with satisfactory results.⁵ The combination of TA with 5FU is more effective to treat scars than TA.⁵ It can be used in different combinations with acceptable results.⁸ Bleomycin seems to be more effective than 5-FU,⁹ but it needs extra care during dilution to prevent inhalation, because it shows a higher incidence of hyperpigmentation, and its manipulation may require extra regulatory rules that may limit its use. Antineoplastic drugs are used in low doses, always combined with triamcinolone. The rationale is to be highly effective with the lowest possible volume. Pregnancy should always be ruled out.⁵

Intense Pulsed Light (IPL) is effective to treat HS/K, targeting scar vascular proliferation and pigmentation.¹⁰ IPL is used immediately before the injections. Scars covered with dressings for several weeks become less pigmented, allowing a safer IPL session, except for higher skin phototypes¹¹ patients. The transient swelling that follows IPL application might enhance TH spreading throughout the scar.

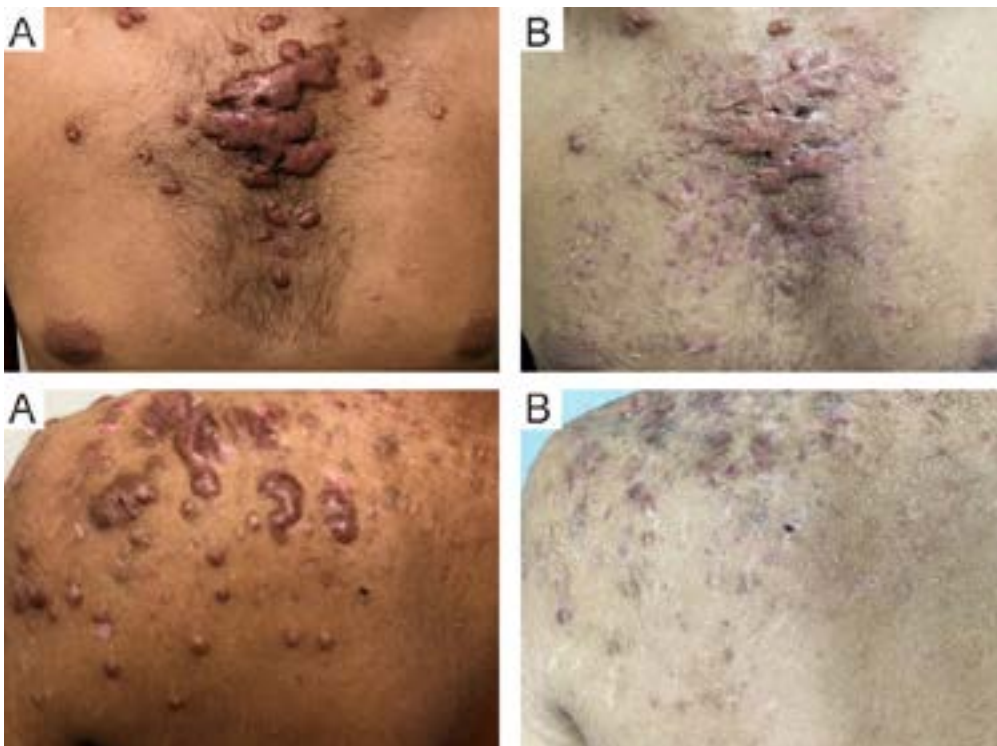
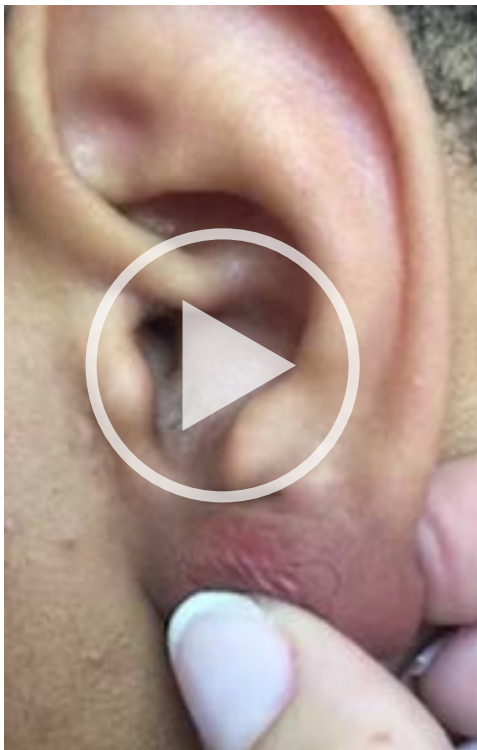


FIGURE 1: This patient presented with keloidal acne lesions despite attempts of treatment with triamcinolone injections; he referred pain during the procedure and regrowth after a few months. **B** - 6 months after occlusive hydrocolloid dressings, with decrease in keloids height and symptoms; remaining keloids are now soft enough to receive injections. **Algorithm: Step A** - analysis showed him to have extensive keloids. **Step S** - he started with hydrocolloids to soften keloids before injections.



FIGURE 2: Algorithm: Step A - retractile scar. **Step S** - treated with occlusive dressings. **Step A** - scar was approached with IPL (1 session) and Step P- microneedling (2 sessions) was used to improve the quality of the scar. **C,D,E,F** - **burned patient** showed progressive improvement with topical retinoids, hydroquinone, glycolic acid, followed by 6 sessions of retinoic acid peels. **Algorithm: Step A** - slightly hypertrophic and hyperpigmented facial scar, if approached with injected or topical steroids, could develop atrophy. She went straight to **Step P** in order to treat pigmentation and the quality of scar.



VIDEO 1. Keloids and scars must be softened to allow for and easier injection.

Algorithm Step 3 - “A”- can be achieved using triamcinolone injections, which may be associated with antineoplastic drugs Bleomycin and 5-FU, with IPL sessions immediately prior to the injections.

Algorithm phase 4. P - Treat Pigmentation and the quality of the skin (A.S.A.P)

K/HS treated with occlusion, pressure garments, IPL, triamcinolone, and antineoplastic drugs become flat and pale. However, hyper/hypopigmentation frequently remains. The last stage of this algorithm (“P”) focuses on improving the quality of the skin and the mixed scar pigmentation. Topical retinoids, the association of glycolic acid and hydroquinone, chemical peels, and microneedling are then combined to achieve a more uniform scar color.¹² Topical tretinoin improves skin/scar by modulating keratinization and the differentiation of fibroblasts and keratinocytes. Retinoic acid (RA) peels are safely used in higher phototypes, leading to clinical improvement in the skin texture and appearance¹³ after 5-10 serial sessions (Figure 2. Table 1).

The inkless tattoo microneedling has been described as an effective “needle dermabrasion” treatment for different scar types, with special benefits regarding achromic scars repigmentation¹⁴ (Figure 2. A, B). Satisfactory results can be achieved after just one session in different types of scars¹⁴ (Table 1).

Similar to other authors, we also treat the achromic scars using topical psoralen combined with daylight exposure.¹⁵ A compounding 0,5%-1% (8-methoxypsoralen) cream was applied to the scar, exposed to sunlight starting 3 minutes/day, 3-4 times/week, and increasing 2 minutes/week up to 15 minutes (Table 1).

Autologous melanocytes transplantation¹⁶ and fat graftings¹⁷ may also be used on the last protocol phase to help achieve

ve improved cosmetic results, as well as IPL, erbium, and CO₂ fractional lasers. K is frequently observed in the skin of color and Brazilian patients culturally prone to sun exposure, leading to scar hyperpigmentation, although during the previous steps the skin usually loses its tanning (Table 1).

Nonablative fractional erbium (1540 wavelength), CO₂ and ablative 2950 wavelength lasers contribute to a final retouch,

allowing improvement of scar color and texture^{17,18,19} (Table 1).

The A.S.A.P algorithm has been extensively used in our clinic. It helps organize the several steps needed to improve those lesions (Figure 1, Figure 2), which may be used as a guide to treat virtually any HS/K after trauma, surgery, piercings, acne, and viral diseases that affect skin and burns (Figure 3). ●

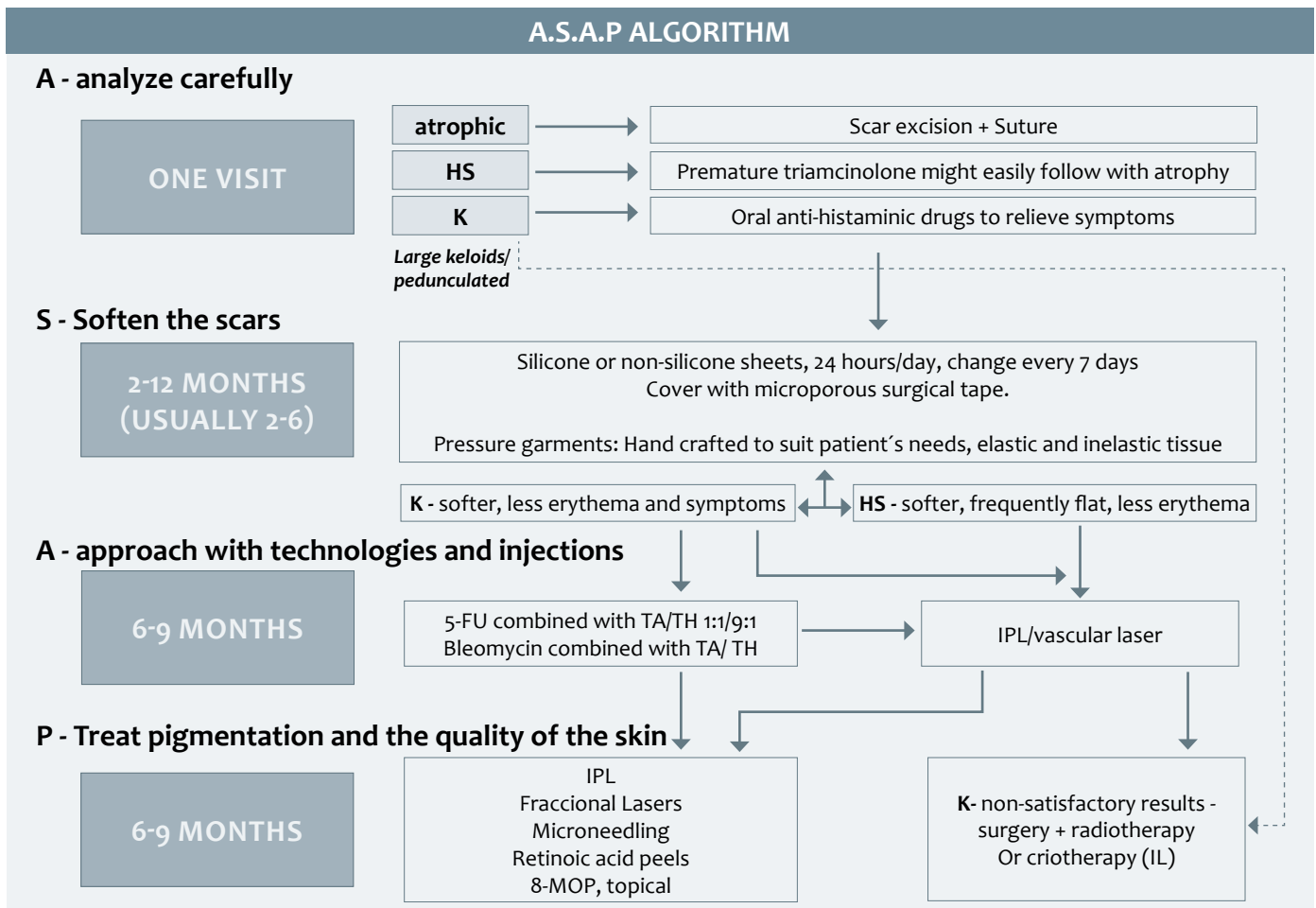


FIGURE 3: The A.S.A.P algorithm can be used to treat virtually all hypertrophic and keloidal scars. **A** - analyze the type of scar (keloid, hypertrophic, atrophic) - Atrophic scars should be excised and replaced by a new scar. **K** and **HS** are treated on the second algorithm phase. HS could develop severe atrophy if treated prematurely with steroids. Keloids usually show significant stiffness that does not allow for easy injections. **S** - Soften scars before injections - using pressure garments, silicone, and hydrocolloid dressings, scars become pale, flatter, and soft - allowing for easier injections of triamcinolone combined with antineoplastic drugs. **A** - Approach with technologies and injections. IPL, when performed immediately before the injections, causes slight edema that also helps injected drugs to diffuse on the fibrous tissue. Triamcinolone may be combined with 5-FU, bleomycin, or calcium channel blockers in monthly sessions. Dressings and pressure garments may continue during this phase. Large keloids such as pedunculated earlobe keloids are treated with excision and radiation, with or without triamcinolone. Finally on the last algorithm phase- **P**- Treat pigmentation and the quality of the skin- fractional and nonfractional lasers, IPL, microneedling, peelings, and methoxypsoralen are combined to promote a more uniform scar.

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Approval of the final version of the manuscript; study design and planning; preparation and writing of the manuscript; data collection, analysis, and interpretation; active participation in research orientation; intellectual participation in propaedeutic and/or therapeutic conduct of studied cases; critical literature review; critical revision of the manuscript.

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