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TAYLOR LIBERATOR FULL FIELD SUBCISION OF ACNE SCARRING UNDER TUMESCENT ANAESTHESIA

Dr Asif Hussein & Dr Cormac Convery look at a method which offers increased efficacy over conventional subcison

Pathophysiology of acne scars

Acne scar morphology is dependent on the severity, depth and extent of the inflammatory and healing process that follows the development of an inflammatory acne lesion. Small superficial lesions will trans-epidermally discharge, and complete healing will often follow.

If dermal inflammation is severe, follicular necrosis and sloughing will produce a focal intradermal atrophic scar. The dermal inflammatory process leads to the destruction of the follicle and also damage to the perifollicular dermal collagen architecture. Re-epithelialisation of these necrotic, sloughed follicles will lead to dilated epithelialised tract formation. These vertical, tunnel-like, post-follicular necrosis remnants form the ice-pick atrophic scar subtype that we are all familiar with.

If the extent of inflammation is greater, or if lesions are grouped, then more diffuse dermal inflammation occurs. The enzymatic activity and inflammatory mediators will destroy deeper structures, leading to atrophic boxcar and rolling scar formation. As these scars mature, there is wound contraction that leads to further indentation.[1]

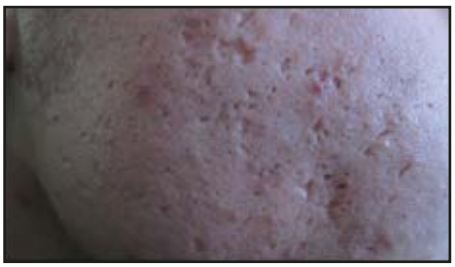

Fig.1 – Ice-pick scars

Fig. 2 – Boxcar scars

Fig. 3 – Rolling scars

If the scarring process and atrophy are intradermal, (i.e. deeper structures and subcutis are not involved), treatment techniques focus on the creation of neocollagenesis through the mediation of a controlled insult to the skin. This controlled insult creates inflammation, collagen neogenesis and remodelling that increases the thickness of the dermis at atrophic scar sites, leading to elevation of the deformity and improvement in the contour. It is important to understand that, with these types of techniques, scars are not removed; scar contour is improved. Scar removal can only be achieved by excisional techniques. Scar contour improvement techniques include chemical peels, fractional-ablative and non-ablative laser, fully-ablative laser, 'TCA CROSS', micro-needling and energy-assisted micro-needling.

Fig. 4 – Intradermal atrophic acne scarring treated with combined fully ablative resurfacing only. [Dr Asif Hussein & Dr Cormac Convery]

Fig. 5 – Tethered atrophic scarring

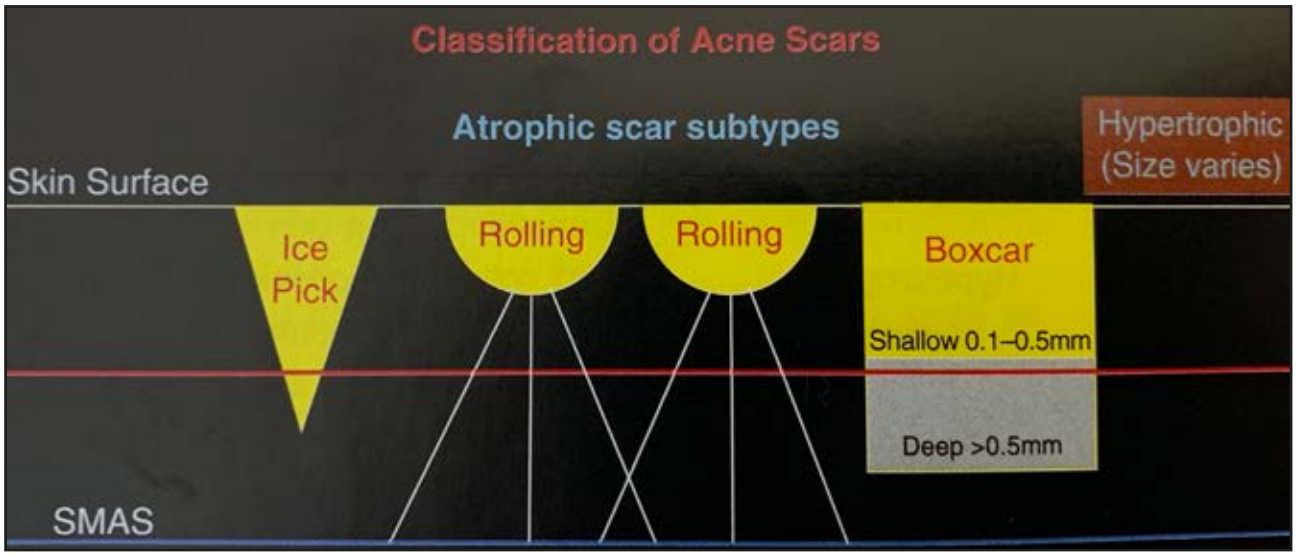

Fig. 6 – Schematic diagram of Atrophic Acne Scar Variants

More severe forms of acne result in nodule and cyst formation. If rupture occurs deep within the follicle, then inflammation spreads well beyond the follicle base. As hair follicle bases are found proximate to the subcutis, infra-infundibular rupture will cause inflammation to spread to the subcutis; deep scarring, sub-cuticular fat necrosis and fibrosis occur. The fibrotic strand development and fat necrosis result in tethering of the subcutis to the Superficial Muscular Aponeurotic System (SMAS). This type of scarring is seen as larger, poorly-defined areas of indentation. The problem is that the subcutis is tethered to deeper layers, and dermal remodelling techniques will not allow for significant amelioration. Fibrous bands anchoring the subcutis to the deeper layers need to be released for skin and scar contour to be maximally improved. Surgical undermining of these scars is required to release the fibrous tethering, and this technique is referred to as subcision.

Subcision - Analysis of existing methods

Subcision, or subcutaneous incision-less surgery, is a minor-surgical technique first introduced by Orentreich and Orentreich in 1995. It is a trademarked technique[2] used in the management of depressed scars or skin grafts[3], atrophic scars and deep rhytids. It utilises a tri-bevelled 18 or 20G hypodermic or Nokor (triangle tipped) needle[6], it's sharp edges manoeuvred under the defect to break the fibrotic strands which tether the scar to the underlying subcutaneous tissue.

Fig 7. 18G Nokor subcision needle

Treatment is delivered after topical or infiltration anaesthesia.

With the needle bevel facing upwards,

Photos courtesy of Dr A Hussein

the original approach was to use side-to-side 'windscreen wiper' motions. Some authors subsequently added 'to and fro' liposuction-like motions. Depth is modified depending on the depth of scarring.

An audible feedback in the form of a snapping sound is heard as the fibrous bands are broken. A small haematoma is allowed to be formed, this actually assisting with tissue remodelling.[3] Haemostasis is maintained with pressure and ice application.

Patients are advised to expect bruising and swelling which may last for up to two weeks. They must also expect a treatment course rather than a single therapy. Darker-skinned patients must be extra-vigilant with respect to sun exposure because of an increased risk of post-inflammatory hyperpigmentation(PIH). Disruption of the pilosebaceous apparatus may result in acneiform cystic lesions or subcutaneous sinus tracts - this may necessitate very low dose intralesional triamcinolone injection and possibly antibiotics. The only contraindications to treatment are bleeding tendency and active infection.

Early outcome analysis[2] in forty patients with rolling scars was very encouraging. Following infiltration with a solution of 1% lidocaine with 1:100,000 epinephrine, an 18-gauge Nokor needle was used to subcise in the standard method. Investigator ratings at 1 month and 6 months post-procedure found an average of 50-60% improvement in the treated sites. No significant complications were observed. Another series[5], followed fifteen patients after three sessions of subcision using a 24G needle. Ratings at 2 months and 6 months were between 40% and 80% improvement. In terms of complications, two patients developed persistent haematoma.

A consistent finding with standard subcision, necessitating repeat treatment, is the 're-depression' which typically starts around day 2-5 post-treatment. This is concurrent with the absorption of oedema and haemorrhage, prompting consideration of suctioning of the subcised scars during the observed recurrence period. A trial[7], which analysed the effect of subcision and repeated suction on acne and other scars at 2 months and 6 months, showed that 60–90% improvement in depth and size of scars could be achieved when the protocol was strictly adhered to.

Some clinicians reported challenges in using the short needles, with some complaining that the lack of handle made them difficult to wield, especially in the treatment of large areas. Concerns were raised that inadvertent rotation of the needle tip could lead to injury of deeper structures[4], while others reported that the needles simply weren't sharp enough.

A level 5 opinion paper suggested that using a handled, sharp, dual-bevel 20G cataract blade[8] allowed more controlled depth and precision of incision.

Fig 8. 20G Cataract blade

Eventually, questions arose around the need for sharpness, wondering whether a cannula would be an appropriate tool for the job.

A pilot study[9] utilised a No. 18 and No. 21 cannula to treat rolling acne scars in eight patients over two sessions. Results were very good with high satisfaction and an approximate 50% reduction in lesion count.

A recent split-face comparison study compared the Nokor needle with a blunt cannula in thirty-four patients.[10] Results were mixed, but the consensus was that results following blunt cannula subcision was better according to patients and assessing physicians.

A randomised control trial (RCT) published earlier this year[11] could have been pivotal had it not been for the decision to compare an 18G cannula with a 27G needle! One hundred patients received two sessions of subcision with a 4-week interval. Investigators' ratings after three months indicated an average improvement rate in appearance, in cases of needle subcision and cannula subcision, of 39.3% and 85%, respectively.

As well as cannula being superior in terms of outcome, the technique was felt to be easier and safer. An interesting finding was the 18% incidence of scar formation in the needle group, compared to no scar formation in the cannula group.

Other blunt methods have been considered, including the 'blunt blade' which was compared with the Nokor needle in another split-face trial[12] involving twenty-eight patients with acne scars, over a 6 month follow-up period. While improvement was comparable, complications were significantly lower, and patient satisfaction was significantly higher in the 'blunt blade' group.

Another study used tumescent anaesthesia (discussed below) and a blunt blade to treat acne scarring in eighteen patients. Moderate to marked improvement was achieved in fifteen of eighteen patients following a single treatment.[13]

Technical advantages and disadvantages of subcision methods

18G Nokor needle/20G cataract blade/ myringotomy blades

An unshielded blade in the superficial subcutaneous plane gives the potential for unintended damage. Also, as the device cuts wherever it is pushed, there exists a significant potential to easily traverse tissue layers; the blade should remain in the superficial subcutaneous plane. As small volumes of local anaesthetic are used typically in this treatment, the safe space is narrow. Rotation of the Nokor needle/blade and a 'to and fro' motion can easily result in damage to deeper structures. As noted above, a Nokor or standard needle is a small instrument that doesn't easily allow for subcision of large surfaces, and as the device has no handle, it is often difficult to control. Some users will attach a small 2ml syringe as a handle to aid in manoeuvring the Nokor needle. As perforator vessels are transected by the blade, significant bleeding and haematoma formation occurs; as well as swelling and bruising, that can take longer than a week to settle, there is an increased risk of infection due to haematoma. Whereas haematoma formation has been postulated to help prevent reattachment of subcised skin, it does mean that any significant subcision

Fig 9. Taylor 'Liberator' Instrument

procedure is associated with significant morbidity and downtime. As a result, Nokor and similar needles should be reserved for a small area or individual scar subcision to limit trauma.

Blunt cannula subcision is, by comparison, much less traumatic than Nokor needle subcision; this is probably due to the relative sparing of perforator vessels. It is important to remember that blunt cannulas were developed to minimise cutting, and trauma, to the superficial sub-dermis. They facilitate the administration of hyaluronic acid dermal fillers in a relatively atraumatic and haematoma-sparing manner. It therefore seems counter-intuitive that a tool that was developed for atraumatic sparing of subdermal structures can then be used to sever the tethering below scars. The reality is that these relatively fine gauge of cannulas (25G or 22G) are in fact 'poking holes', instead of completely releasing tethering. This results in incomplete scar release; some additional effect often being delivered through deposition of a dermal filler. The technique is also quite challenging due to the tendency for cannulas to bend. Of course, the advantage here is that subcision is relatively atraumatic and recovery is quick. But, due to the limitations described, treatment must be continually repeated, entailing significant cost and time commitments for the patient.

Blunt blade subcision is an evolution of blunt cannula subcision; it provides a longer, more rigid instrument with a handle, allowing greater user control. As the tip is flat and blunt, the device can be used to deliver localised, controlled damage with the easy maintenance of plane and orientation.

Taylor Liberator full field subcision with tumescent anaesthetic

Dr Mark Taylor from Utah has taken the blunt instrument technique and refined it, introducing the Taylor Liberator, which is depicted in Fig. 9. This long-handled instrument incorporates a 'W-shaped', blunt tip. The tip resembles that of a flat-bladed screwdriver, which has two notches (hence the 'W' profile) containing a u-shaped blade, which is sharp. Dr Taylor's technique includes the use of tumescent anaesthesia and a 'to and fro' motion with the 'liberator'. Using this 'to and fro' motion, the operator ensnares the fibrous bands within the notches of the instrument, which are subsequently divided by the sharp areas within the notches. A small, 4mm entry port is made with a No. 11 or No. 15 blade to facilitate the entry of the liberator into the superficial subcutaneous plane.

The authors have been using this method of subcision for acne scars since 2016 when Dr Hussein introduced the technique to the UK. They have performed well over a hundred cases in this time. It is the authors' opinion that this subcision method allows for complete transection of fibrotic bands with minimal bleeding, swelling and haematoma formation. It offers a swift recovery and sustained long term results without the need for procedural repetition.

Tumescent anaesthesia can be considered a key evolution in the treatment of subcision, offering the following advantages:

- Ensures adequate anaesthesia
- Adrenaline limits haemorrhage and haematoma formation
- The fluid load provides 'hydro-dissection' of the dermal-subcutaneous tissue-SMAS plane
- Separation of tissue planes provides additional protection for deeper structures and a larger space for subcision device manoeuvring
- The addition of a steroid to the mixture also allows for the suppression of inflammation and a reduction in inflammatory mediated re-adhesion of the scar sub-dermis to the SMAS. It also facilitates minimal swelling and hastened recovery following subcision

The authors use a tumescent solution containing:

- 0.9% saline
- 2% lidocaine
- sodium bicarbonate 8.4%
- Triamcinolone
- Adrenaline (1 in 1000)

Sharp and blunt subcision may be delivered more safely by incorporating the use of a tumescent solution.

It is well accepted that combination therapy provides superior results in cosmetic practice. Acne scarring is often treated using a CO_2 laser,

Photos courtesy of Dr A Hussein

and outcomes were shown to be significantly superior when used in combination with a single subcision session.[14] Mean patient satisfaction scores were significantly higher with the combination method compared to the laser alone.

Dr Taylor reported on a total of one hundred and fourteen patients with rolling acne scars, treated in one session with a 20% trichloracetic acid chemical peel, subcision with the 'Liberator', and CO_2 laser under tumescent anaesthesia.[15] The mean improvement after a single treatment was 2.9 on a scale of 1 to 4, with few complications. Ninety per cent of the patients were satisfied with their final result and desired no additional treatment.

In our practice, Taylor Liberator subcision is performed one month before combined fully ablative CO_2 resurfacing. No greater incidence of post-laser healing complications have been visualised in our practice.

Methodology of Taylor Liberator subcision

The entire procedure will be performed with the patient in a supine position. A headband will keep hair away from the face. The subcision procedure must be formed using aseptic technique. The face will be cleansed with an aqueous chlorhexidine solution.

Tangential illumination helps to identify the tethered scar margins which are marked with a sterile marker. This is essential because the infiltration of a high volume of tumescent renders landmarks difficult to appreciate. Marking facilitates a more targeted subcision, avoiding needless risk to various important structures.

The tumescent solution can now be administered using the high flow HK surgical pump, giving set and a 22G blunt cannula. As the recommended pump has a high flow rate, rapid infiltration can be achieved. This is crucial for the technique because high flow rapid infiltration allows hydrodissection and maximal separation of the subcutis from the SMAS. This safely distances the underside of the dermis from underlying neurovascular structures. Creating this gap dramatically increases the safety of subcision and reduces the risk of nerve damage and vessel disruption/ haematoma. Following infiltration, a 25-minute pause is given to allow for the tumescent mixture to create adequate anaesthesia and vasoconstriction. Prior to commencing the subcision a further 'top-up' of tumescent can be applied to maximise tissue separation.

A small puncture incision is made with a No. 11 blade and the subcision probe can be passed under the dermis with relative ease. The notched tip directs scar bands towards the blade element of the probe. The operator must maintain movement, with force applied, such that the probe skates along the underside of the dermis, away from deeper structures. When passing the probe under the dermis, two elements of resistance will be encountered:

- resistance from the fibrous bands that tether the acne scars and,
- as the probe encounters the fibrous septae that connect the Superficial Musculo-Aponeurotic System (SMAS) to the dermis.

Both these resistances will be overcome as the probe dissects through; it is inevitable to have some partial dissection of cutaneous ligaments but not to any harmful extent.

Fig 10. Marking and tumescence of the subcutis

Fig 11. Taylor Liberator probe entry point

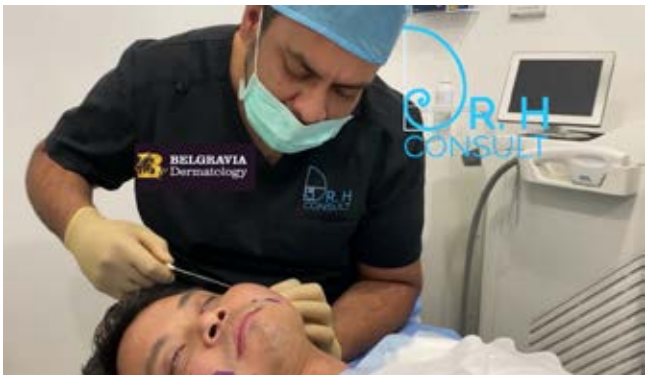

Fig 12. Dr Asif Hussein performing Taylor Liberator subcision

Photos courtesy of Dr A Hussein

Following completion of the subcision, the probes can be removed; the entry site is small and free of any significant tension, hence a suture is unnecessary.

On completion, Tegaderm dressings are applied, and the patient is given appropriate wound management instructions.

Relevant anatomy

The tip of the subcision probe passes between the superficial subcutaneous plane and the mid subcutaneous plane and, as a result, vessels of the subdermal plexus are left largely intact. Some damage to axial arcuate vessels can be envisaged, but no significant vascular compromise will result; overall the tip of the probe is passing parallel to these axial vessels, so dissection risk is relatively reduced. Haematomas are limited by the adrenaline content of the tumescent.

The tumescent effectively expands the vertical diameter of the mid subcutaneous plane. As the SMAS invests the major vessels and nerves, the distance between the plane of subcision and these important structures is increased. This is why turgid tumescence of the tissues of the mid subcutaneous plane greatly enhances safety.

The probe entry point is in the hairline of the temporal region. The superficial temporal artery and temporal branch of the facial nerve are the key at-risk structures in this area. Turgid tumescence allows an increase in the vertical distance between the probe entry point and these two structures that run just below the temporal-parietal fascia. It is uncommon for extensive subcision to be required in the temporal region, however, extreme caution must be used when doing so. The constant application of a traction force, away from the SMAS and into the dermis, must be observed when subcising the temporal region.

Recovery

Swelling from the tumescent is dissipated within the first 24 hours, with normal facial contour returning within this time. A further 24 hours should pass before dressings are removed; this ensures sufficient wound integrity of the entry ports. At this stage, the face can be washed normally, and patients can return to work with little to no bruising. A follow-up call is made to the patient, 24hrs after the procedure, to assess for the presence of movement asymmetry and facial nerve trauma. Patchy sensory disturbance is to be expected, and this usually normalises completely within three months of the procedure.

Fig 13. Appearance of patient 24hrs post Taylor liberator subcision

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Dr Asif Hussein - 'Taylor Liberator' subcision case results

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