TRANSCERVICAL SUBMANDIBULAR APPROACH: A PATIENT AND OBSERVER SCAR OBJECTIVE SCORE APPRAISAL

Adham A. ElAshwah[1] *PhD,* Nada M. H. Fahmy[2]* *PhD,* Noha Y. Dessoky[3] *PhD,* Haytham Al-Mahalawy [4] *PhD.*

ABSTRACT

OBJECTIVE: The purpose of this study was to assess the functional and aesthetical performance of transcervical submandibular incision for various procedures in the submandibular area.
MATERIALS AND METHODS: The study is a prospective case series for the introduction of the patient and observer scar assessment scale in the postoperative assessment of linear surgical scars in the neck region. Primary outcome variable was the functional and aesthetical outcome performance of transcervical submandibular incision. Statistical significance was set at the 5% level.
RESULTS: Twenty-one patients with various procedures in the submandibular area were enrolled in this study. Only three patients reported a transient mild dysfunction in the first week, which dissipated in the subsequent follow up period. The patient side of the scar assessment scale ranged from 7 to 19, with a mean record of 10.2 ± 3.45 and a total satisfaction rate of 85.7% was reported by the patients. The observer side of the scar assessment scale ranged from 19 to 25, with a mean record of 21.9 ± 1.42. Furthermore, an extreme degree of reliability was reported when evaluating the outcomes of both different observers (P<0.001).
CONCLUSION: The transcervical approach granted the patients a safer approach, regarding the safety of the marginal mandibular nerve, and a more aesthetically pleasing outcome with superb patient satisfaction. Furthermore, the utilization of the Patient and Observer Scar Assessment Scale in linear facial scars assessment offers a reliable and consistent tool with easy to implement tool.
KEYWORDS: transcervical approach, mandible, scar quality, posas.
RUNNING TITLE: Scar quality appraisal of Transcervical Submandibular Approach.

1 Assistant Professor of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University.
2 PhD, Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University.
3 Lecturer of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University.
4 Associate Professor, Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Fayoum University, Fayoum, Egypt

* *Corresponding Author:*
E-mail: nada.m.fahmy@gmail.com

INTRODUCTION

The Risdon method is one of the most beneficial and widely used approaches to the mandible, particularly the body and angle sections. Access to the submandibular space is required for a plethora of operations in the maxillofacial field, such as mandibular osteotomies, fractures of the angle, body, or even the condyles, TMJ ankylosis operations, lesions of the submandibular gland, and some uncommon situations like iatrogenic displacement of third molar in the submandibular space (1,2).
One of the main precautions in the placement of the submandibular incision is the relation of the incision line to the arborizated branches of the facial nerve. The marginal branch is the one at danger during the incision placement (3). Any nerve paresis affects their supplied muscles, depressor labii inferioris and depressor anguli oris, causing flattening of the ipsilateral lower lip and cause its ptosis. This functional impairment causes a grave cosmetic deformity and asymmetry. Injury of the marginal mandibular branch is reported to range from 0 to 20% (4).
Another guideline that is followed during the choice of the neck incision line is its relation to *Resting Skin Tension Line* (RSTLs). These lines owe a transverse orientation, that gets more diagonal further away from the mandibular boundary. Adhering to the skin crease is the best way to conceal the incision line and to have an inconspicuous postoperative surgical mark and minimal scar formation (5,6).
The result of any surgical incision is a scar. Numerous practical, aesthetic, and psychological effects may result from scars. Scar tissue typically differs from healthy skin by having an abnormal color, growing in thickness, having an uneven surface, losing its flexibility, and contracting or

expanding its surface area. Itching and soreness are usually experienced by the patient, especially if the scar has hypertrophied (3-5). The etiology, size, location, suturing method, wound care, as well as a person's age, race, and genetic susceptibility, all affect the scar's characteristics (6).

Evidence-based scar evaluation research are utilized to eventually improve scar therapy and prevention. There are tools for objectively measuring surface area, thickness, surface texture, softness, and skin and scar color (7). Despite that, the use of objective tools is typically time- and money-consuming with no added value over the imperative subjective analysis of the scar quality. Subjective scar assessment scales are thought to be more clinically beneficial because they are simple to use and noninvasive (8).

There is currently no established subjective scar assessment scale (9,10). For the category of burn scars, the Vancouver Scar Scale is now the tool that is used the most. Although the evaluation of symptoms like itching and pain, which they believed to be crucial in the treatment of scars, was absent from the Vancouver Scar Scale, the authors of the original publication on the scale have already admitted as much. Additionally, it is still challenging to apply the Vancouver Scar Scale to different kinds of scarring (8,11).

For a purely subjective assessment of various forms of scar formation, the Patient and Observer Scar Assessment Scale was developed. According to contemporary studies, it is more reliable and consistent than the Vancouver Scar Scale for evaluating burn scars (12,13). In 2005 van de Kar et al. implemented the POSAS in the assessment of linear scars. They stated that the second version of the POSAS is an appropriate arbitrary instrument for assessing linear scars (8).

Hence, this study was implemented with the aim of the introduction of the POSAS v2.0 in the postoperative assessment of linear surgical scars in the neck region. Furthermore; the study was limited to the recently utilized transcervical second-crease neck incision for the access to the submandibular region.

MATERIALS AND METHOD

Study Design

This study was conducted in a prospective manner with cohort analysis for the scar maturation and final outcome analysis. Ethical approval was granted for the analysis performed in this study by the local ethical committee (IRB NO: 00010556-IORG: 0008839). Recruitment was performed from those admitted to the Outpatient Clinic of Alexandria University Teaching Hospital. Inclusion criteria in this study was set as any presented patient requiring extraoral access to the mandibular bone or submandibular gland with an incision length greater than 5 cm. All patients were operated upon by the same surgeon (A.A). Included patients are of no gender predilection and must be of age, more than 20 years old. Patients with multiple operations in this region, or those with lacerations are excluded. Informed consent was required from each individual included in this study.

Surgical procedure

All enrolled patients were operated upon under general anesthesia. A second neck crease incision was utilized to place the transcervical incision, with a distance difference from the inferior border of the mandible of 2.5 cm. Incision was carried through the skin and subcutaneous layer in the regular fashion with platysma and deep fascia dissection at the level of the cervical flap. The dissection is continued in the regular fashion according to the nature of the operation. A layered closure with resorbable sutures for the deep layers was performed, followed by an inter-dermal layer closure for proper wound approximation. The final layer of the skin was closed in a running subcuticular mattress manner with 5/0 proline suture (Figure 1).

Figure 1: Sutured incision of a mandibular trauma case managed with transcervical neck incision.

Postoperative Follow-up

Motor nerve Examination

During the early follow-up period, each patient was examined for the marginal mandibular nerve function, neck mobility, and cervical nerve function at one-, four-, and six-weeks. House-Brackmann evaluation was used to categorize the affected patients (Table 1). The motor nerve examination was performed by a single operator blinded to the operating team.

Table 1: Motor nerve examination**.**

Assessed Nerves	
Marginal Mandibular	The ability of the patient to smile, grin showing his teeth and moving his lower lip lateral and downwards.
Cervical	The ability of the patient to shrug the neck and activate the platysma muscle.
Neck Mobility	The ability of the patient to move the neck to both sides.
House-Brackmann Grades	
Grade I	Normal function.
Grade II	Mild dysfunction.
Grade III	Moderately dysfunction.
Grade IV	Moderately-sever dysfunction.
Grade V	Sever dysfunction.
Grade VI	Total paralysis.

Scar Assessment

All patients were recalled 1 year to the date of the operation for scar evaluation. The yearlong follow up span was selected based on the maturation of the scar. Patient and Observer Scar Assessment Score (POSAS v2.0) was utilized in this study for a scar clinimetric analysis. According to the Dutch Burns Foundation, the POSAS is bi-scaled tool for a subjective and objective evaluation of different variants of scars. van de Kar et al. in 2005 reported the implementation of the POSAS in analysis of linear scars (8,14).

The patients side of the score was conducted by asking the patient to answer a 1 to 10 numerical scale for six questions, where a 1 score indicates the best and 10 as the worst possible outcome. Each question focuses on the magnitude of either pain, itching, color change, stiffness, thickness, and scar irregularity. The obtained scores were added up to a minimum of 6 and a maximum of 60. A patient-related amendment was added by asking the patients about the overall acceptance and satisfaction of the appearance of their scars, ranking from 1 as best satisfaction and 10 as least satisfaction (Figure 2).

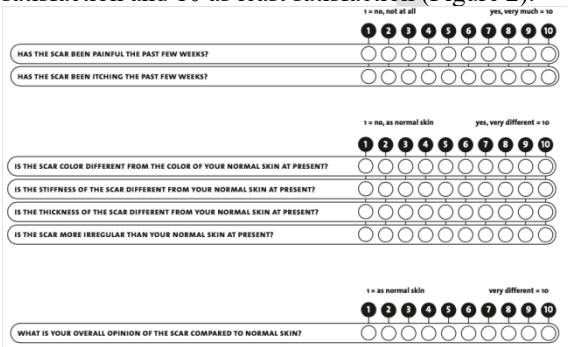

Figure 2: Patient-Side of the Patient and Observer Scar Assessment Scale (POSAS v2.0)**.**

The observer side of the POSAS score was conducted by 2 separate consultants of oral and maxillofacial surgeons with more than 15 years of experience in the field each from the oral and maxillofacial surgery department, Alexandria University. Each clinician examined the scar and evaluated the scar vascularity, pigmentation, thickness, pliability, relief, and surface area. Explanation of each category is presented in Table 2. The observers should be instructed to preferably compare the scar to the normal skin on a comparable anatomic location. The obtained scores were added up to a minimum of 6 and a maximum of 60. The two surgeons overall opinion and satisfaction was also scored (Figure 3).

Table 2: Observer Scale interpretations**.**

Vascularity	:	Presence of vessels in scar tissue assessed by the amount of redness, tested by the amount of blood return after blanching with a piece of Plexiglas.			
Pale	Pink	Red	Purple	Mix	
Pigmentation	:	Brownish coloration of the scar by pigment (melanin); apply Plexiglas to the skin with moderate pressure to eliminate the effect of vascularity.			
Hypo-pigmentation	Hyper-Pigmentation	Mix			
Thickness	:	Average distance between the subcutical-dermal border and the epidermal surface of the scar			
Thicker	Thinner				
Relief	:	The extent to which surface irregularities are present (preferably compared with adjacent normal skin).			
More	Less	Mix			
Pliability	:	Suppleness of the scar tested by wrinkling the scar between the thumb and index finger.			
Supple	Stiff	Mix			
Surface	:	Surface area of the scar in relation to the original wound area.			
Expansion	Contraction	Mix			

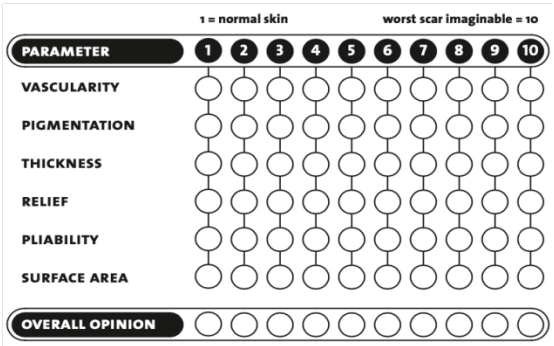

Figure 3. Observer-Side of the Patient and Observer Scar Assessment Scale (POSAS v2.0)**.**

Statistical Analysis

Data were analyzed using IBM SPSS for windows version 23.0. (IBM Corp, NY, USA). Descriptive analysis of the mean value recorded in each subitem, overall score, and overall satisfaction for both sections of the PSOSS scale was performed. In the observer score, reliability of the obtained data from both observers was assessed by Inter-observer reliability using two-way mixed ICC test to determine the degree of conformity between the iterations of two separate auditor. Significance level was confirmed at *P* value of 0.05.

RESULTS

The study enrolment pool was from the period of June 2019 to June 2021, where 31 patients meeting the inclusion criteria were enlisted. Of the enlisted 32 patients, 7 patients failed to show in the follow-up session, while 4 patients suffered from extraoral wound complication that required reoperation, so their record were omitted from the study. 21 patients reported to the one-year examination session and their characteristics is tabulated in Table 3.

Table 3: Demographic Analysis of the study**.**

n=21	N	%
Gender		
Male	12	57.1
Female	9	42.9
Side		
Right	13	61.9
Left	5	23.8
Bilateral Collar	3	14.3
Etiology		
Mandibular Trauma	10	47.6
Mandibular Resection	8	38.1
Submandibular Gland Removal	3	14.3

The most prevailing etiological factor for the utilization of the submandibular incision was mandibular trauma, with 10 cases. This was followed by mandibular resection cases in 8 patients, and submandibular gland excision in 3 patients. The reported 21 patients had a slight male predilection with a 1.33:1 male to female ratio. The patients in the study pool had an age that ranged from 21 to 49 years, with a mean reported age of 31.7 ±9.01 years. The right side of the patients was solely operated in 13 patients, while the left side was operated in 5 patients. A second crease collar incision, spanning from the right to the left side of the patient was utilized in 3 patients.

In all of the examined patients reported a Grade I House-Brackman value for both neck mobility and neck shrugging test in all of the examination period. Regarding the marginal mandibular nerve function, 3 patients reported Grade II mild dysfunction in the first week. All three patients showed grade I normal function in the consequent follow-up session. None of the patients showed asymmetry in their mouth corners. In the three patients with transient paresis in the course of the marginal mandibular nerve, their report had no impact on their satisfaction with the scar result

Patients scar analysis

Regarding the patients scores, the mean reported score for each questioned item is reported in Table 4. The aggregate score for each patient ranged from 7 to 19, with a mean record of 10.2 ± 3.45. Overall patient satisfaction was high, with a mean reported value of 2.23 ± 0.13. A score above the 5 mark was reported in only 3 patients out of the examined 21 patients. A total satisfaction rate of 85.7% was reported by the patients.

Observers scar analysis

Regarding the observer's analysis, the mean of both observers reports for each examined item is reported in Table 4. The aggregate score for each patient ranged from 19 to 25, with a mean record of 21.9 ± 1.42. Overall observer satisfaction was sublime, with a mean reported value of 1.87 ± 0.13. This indicates that the examined scars closely resemble the appearance of the normal skin.

Reliability analysis between the records obtained by each observer showed an excellent degree of reliability. The obtained Interclass correlation coefficient values ranged from 0.785 to 0.95, all of which had a statistical significance and showing good to excellent degree of reliability (p <0.001) (Table 5).

Table 4: Mean values of the Patient and Observer Scar Assessment Scale (POSAS).

Patients Scale	Mean ± SD	
Pain	1.38 ± 0.50	Total Score Mean = 10.24 ± 3.45. Total Score Range from 7 to 19.
Itching	1.29 ± 0.46	
Color	3.05 ± 1.12	
Stiffness	1.52 ± 1.03	
Thickness	1.43 ± 0.60	
Irregularity	1.57 ± 0.87	
Overall satisfaction	2.23 ± 0.13	
Observers Scale	**Mean ± SD**	
Vascularity	2.57 ± 0.51	Total Score Mean = 21.86 ± 1.42. Total Score Range from 19to 25.
Pigmentation	4.43 ± 0.60	
Thickness	3.86 ± 0.96	
Relief	3.52 ± 0.60	
Pliability	1.14 ± 0.36	
Surface area	6.33 ± 0.48	
Overall satisfaction	1.87 ± 0.13	

SD: standard deviation.

Table 5: Intra Examiner Reliability of the measurements made by the two different observers.

Observers scale	ICC	*P*
Vascularity	0.785	**0.027***
Pigmentation	0.954	**<0.0001***
Thickness	0.792	**0.032***
Relief	0.841	**0.012***
Pliability	0.894	**<0.0001***
Surface area	0.954	**<0.0001***
Overall observer satisfaction	0.948	**<0.0001***

ICC, Interclass Correlation Coefficient.
ICC Outcome Values: <0.5 Poor agreement, 0.5 to <0.75 Moderate agreement, 0.75 to <0.9 Good agreement, 0.9 - 1.0 Excellent agreement.
*Statistically significant difference at *p* value≤0.05.

DISCUSSION

Although scar formation is a daily concern for all surgical specialties, there is no consensus on the best techniques for evaluating scars. *Patient and Observer Scar Assessment Scale* was first introduced by the Dutch Burns Foundation for the assessment of the burn scars quality; however, the basis of this scale foundation is based on the various points that determines any type of scars. A plethora of governing factors determine the incision placement in the submandibular area with various iterations leading to bone and gland exposure (6). This study was conducted in order to evaluate the aesthetical and functional performance of a more inferior, neck-oriented incision placement for various mandibular-related procedures. Furthermore, it was aimed to implement the POSAS v2.0 into providing a clinimetric analysis for linear scars of the neck.

All of the examined patients reported a grade I normal function for the marginal mandibular nerve course, par from three patients with transient drawbacks that dissipated in the second clinical follow-up session. On the other hand, all patients reported normal neck mobility and platysma function. Determining the position of the incision is governed by a group of factors, off which the relation to the Marginal Mandibular Nerve (MMN) is the main prerequisite. The arborization of the MMN is determined in the literature as it rarely descends below the inferior border of the mandible (5). Despite that Sindel et al. (2021) conducted a cadaver investigation to determine the position of the MMN in relation to the lower border of the mandible and reported that the nerve may reach as far as 8-mm from the inferior border of the mandible (15). Hence the recommended incision position is 2-cm from the mandibular lower margin (5). In this study the functional performance of the utilized modified incision was superb, where none of the cases developed permanent nerve damage or any functional and aesthetical asymmetry.

The fact that *Resting Skin Tension Line* (RSTLs) gets more transverse away from the boundary of the mandibular bone, taking the incision in the skin crease towards the midline will have a more inferior position than that near the ramus and angle of the mandible (5,6). This orientation gives the famous mastoid to hyoid transcervical incision placement, which was utilized in cases with mandibular resection in this study. Taking the incision toward the hyoid in the midline provides protection to the superior skin flap, as the platysma is scares in the midline (5,16). This is presented in this study with the lack of complications and skin dehiscence in any of the operated cases. Furthermore, maintain the integrity of the platysma muscle helps in achieving an uneventful postoperative healing.

In this study, various maxillofacial applications were chosen to fully evaluate the procedure's adaptability. Similar approach was taken by Ghanem et al. (2021) (6). This study on the other hand included more mandibular-trauma patients. All of the operated patients were managed with acceptable acceptability in each case. The outcome of this study may put an emphasis on the importance of modifying the outdated incision technique with the transcervical incision for young residents.

The scar assessment session was set at 12-month postoperative. Similar period was reported by Ghanem et al. (2021) and Delsing et al. (2016) (6,13). Following an initial healing period and a 6 to 18 weeks period of epithelization, scars are usually developed after linear surgical incision closed by primary intention (17,18). This is why early assessment of scars is erroneous, as the scar is not

yet matured and epithelized (8,14). Commander et al. (2016) states that scar maturation and remodeling phase to regain full strength of the skin collagen fibers is a 12- to 18-month process (11). That is why this study respected the maturation phase of the skin wound healing in order to obtain a valid outcome of the utilized transcervical incision. Furthermore, the long follow up period opted for the dissipation of the psychological factor on the patient assessment, where a worse patient satisfaction may be reported if the assessment was performed in a period closer to the operation.

Linear surgical scars do not own a specific scar assessment scale. van de Kar et al. (2005) were the first to introduce the POSAS in the assessment of linear scars (8). They report that POSAS demonstrated great internal consistency. Delsing et al. (2016) reported the use of POSAS v.2.0 in the assessment of neck surgical incisions for the removal of submandibular glands (13). Fearmonti et al. (2010) states that the POSAS is the first scar scale to focus on patients subjective symptoms in order to expand the objective data revealed by the observer opinion (19). Carrière et al. (2019) called scar experts for the need of a multi-center Delphi study, with cooperation of an patients focus groups in order to put a definition of scar quality, conjoining both experts and patients perspectives (20).

All objective factors were reported at the lower end of the scale, , by both observers. Similar outcome was reported by Brown et al. (2010) and Delsing et al. (2016) (13,18). The examined factors in the observer scale were selected after careful scrutiny of clinical expertise and different scar analysis instruments (8,14). Vascularization, pigmentation, thickness, relief, pliability, and surface area are the chosen six observer examination criteria. Several reports demonstrate that this part of the scale could be performed by photographic examination, with no need for the patient clinical visit (13,21-23). Delsing et al. (2016) conducted the observer part of the POSAS with the utilization of recent photographic picture (13). However, the official POSAS guidelines states that the use of the second version of the scale is not suitable for photographic assessment (8,14). Durani et al. (2009) states that several scar assessment criteria require physical examination for a proper analysis (9). In 2022, the POSAS V.3 was published with the introduction of a generic version and another separate version for postsurgical scars, the linear-scars version (20). Carrière et al. (2022) limit the use of the linear scar version for those with narrow and straight appearance, hence the scale could be used for post-surgery and post-traumatic scars (20).

Regarding the patients scores, the aggregate score for each patient ranged from 7 to 19, with a mean record of 10.2 ± 3.45 with high overall patient satisfaction. Ghanem et al. (2021) reported similar outcome (6). Four of the patient's assessment criteria mirrors those asked by the observer for assessment, color, thickness, relief, and pliability. The main subjective criteria were pain and itching (8,14). Unlike the old solely observer-oriented scales, the POSAS provides an assessment for criteria that are relevant to the patients which greatly diminish the patient's quality of life (24). Despite that, POSAS lacks the functional means to identifying whether the reported pain or itching impede the quality of life (8,14,23).

The overall patient satisfaction in this study reported a pooled 85.7%. Stamataki et al. reported a satisfaction rating of 79% one year after patients underwent combination SMGE and parotid duct ligation (25). Delsing et al. (2016) reported a higher 96.5% patient satisfaction rate (13). They added a question where if the patient would choose similar treatment knowing the final result. Their report a whopping agreement were all patients reported that they would choose the same treatment again (13).

The three patients that were dissatisfied with their scars two of which are trauma patients, and one was operated on for submandibular gland removal. However, the fundamental cause of the dissatisfaction could not be pinpointed by the questioned or determined by either the patient of the surgeon. On the other hand, all three patients reported good observers reports with no abnormal reports of any of the examined criteria. These subjective patients result may be inflicted by the psychological impact of their treatment. After one year from the operation, the two-trauma patient still suffered from occlusal irregularities, while the gland-excision patient developed sever xerostomia postoperatively. The adverse effect from the operation outcome may have put a psychological bias to the patient assessment of the quality of the scar. This may point out one of the great advantages of the POSAS assessment tool in comparison to other purely subjective scales. The observer assessment of the scar gives a more objective, academic assessment devout of the psychological bias.

In this study the results of the patients and observers' scales complement each other, with no reported discernible difference. The integration reached by the POSAS is unmatched by other scar analysis scales. This study provides evidence that, while respecting the MMN's anatomy, moving the incision lower in the natural neck crease will produce a positive aesthetic outcome. The patient's ability to resume his social life determines the aesthetic outcome.

Scale reliability is defined as the reproducibility of compatible outcomes by different observers (21). The study reported a good to excellent levels of reliability when testing the outcomes produced by two different observers (p<0.001). A similar favourable reliability analysis was presented by van de Kar et al. (2005) and Delsing et al. (2016) (8,13).

van der Wal et al. (2012) states the reliability is one of the main prerequisites in order to label an assessment tool as a clinimetric scale, along with validity, responsiveness, and feasibility (10). The prospective nature of this study limited the test of the clinimetric requirements to only assessing the scale reliability. Carrière et al. (2019) demonstrates that POSAS owes an acceptable interobserver reliability (20). In this study both observers were first introduced to the POSAS-observer part of the scale at the start of the study. They both reported, and showed, ease of application and robust comprehension. This may further indicators the feasibility of this scale in the assessment of linear scars.

This study limited by the lack of procedure standardization. Different procedures in the submandibular region comes with different incision length, tissue manipulation, retraction and dissection extent, and overall operation period. All of this may act as cofounding factors for the study outcomes. This choice was opted for the propagation of the included sample pool for proper verification of the outcome of the POSAS scale. The favourable objective functional and subjective long-term outcomes of the transcervical placement of the submandibular incision may help in popularize its use in smaller incision lines, with better expectations

CONCLUSION

The choice of a skin crease for the placement of neck incisions is the main regulation for the placement of the submandibular incision, along with the relation to the marginal mandibular nerve. With respect to the limitation of the study, placing the neck incision in a lower place than the regular Risdon approach granted the patients a safer approach, regarding the safety of the marginal mandibular nerve, and a more aesthetically pleasing outcome with superb patient satisfaction. Furthermore, the utilization of the *Patient and Observer Scar Assessment Scale* (POSAS v2.0) in linear facial scars assessment offers a reliable and consistent tool with easy to implement tool.

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Conflict Of Interest

The authors declare that they have no conflicts of interest. The authors declare that they received no funding to perform this study.

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