"COMPARISON BETWEEN RETROMANDIBULAR ANTEROPAROTID APPROACH, RETROMANDIBULAR TRANSPAROTID APPROACH AND HIGH SUBANGULOMANDIBULAR APPROACH FOR MANDIBULAR SUBCONDYLAR FRACTURE FIXATION : A PROSPECTIVE RANDOMISED STUDY"

ABSTRACT:

Need for the Study : Condylar Fracture still remains a controversy. The decision regarding type of approach depends on various functional and esthetic parameters . The current study compares the retromandibular anteroparotid approach, retromandibular transparotid approach and high subangulomandibular approach with respect to these parameters.

Materials and Methods : The study was conducted on 33 subjects in SANJAY GANDHI INSTITUTE OF TRAUMA AND ORTHOPEDICS, BANGALORE. Three groups with 11 patients in each were evaluated and compared based on facial nerve injury; scar esthetics and sialocele formation with follow up for 3 months. Collected data were analyzed using chi square test.

Result : Comparison of Incidence of Facial Nerve Injury between diff. time intervals in each group using Cochran's Q Test showed Facial Nerve Injury was in 9.1 % in Group A, 36.4 % in Group B and 18.2 % in Group C on Day 1. The result in Group B was significant with the p value of 0.02. Comparison of Incidence of Sialocele Formation between 3 groups at different Post-operative time intervals using Chi Square Test showed Sialocele Formation in Day 1 for 27.3% in Group A, 45.5% in Group B and nil in Group C with statistically significant P value of 0.04. Comparison of mean scar esthetic score was 1.45+-0.52 in Group A, 2.36+-0.51 in Group B and 2.45+-0.52 in Group C (p value 0.001). Statistically significant results was found in comparison in between Group A vs B and Group A vs C with p value of 0.002 and 0.001 respectively.

Conclusion : On the basis of this study, Group A had the least incidence of Facial Nerve Injury and Scar Esthetic whereas Group C had the least incidence of sialocele formation. Also, the accessibility of the fracture site with the high subanglomandibular approach was an issue hence it's choice should be preferred only for low subcondylar fracture fractures rather than high subcondylar fractures.

Keywords : Condylar fracture, facial nerve injury, sialocele formation, scar esthetics

1. INTRODUCTION:

The management of condylar fractures is still controversial, despite the fact that they account for 17.5% to 52% of all mandibular fractures (1). Malocclusion, limited mouth opening, and dysmasesia are among the consequences linked to condylar fractures that cause patients to struggle in their daily lives. There is still a chance of temporomandibular joint dysfunction, condylar deformity, and restricted mouth opening even when condylar fractures are surgically corrected. This explains why condylar fractures are difficult to treat (2). Various writers have developed their own strategies. Nonetheless, conservative (closed) and surgical (open) treatment are the two primary approaches being employed (3).

One of the greatest risks associated with treating mandibular condyle fractures surgically is damage to the facial nerve's branches, which could result from hardware application, tissue dissection and retraction, or manipulation of the fracture fragments (4). A variety of factors influence the choice of approach to be taken for a patient. It is necessary to take into account not only the functional results (mouth opening, deviation, etc.), but also the particular adverse effects of certain surgical techniques (facial nerve injury, salivary fistula, visible scars, etc.), as well as the patient's expectations (5). Accordingly, the current study contrasts the retromandibular anteroparotid approach, retromandibular transparotid approach, and high subangulomandibular approach in relation to these parameters and connects them to the distinctive characteristics of condylar fractures in the mandible.

2. AIM:

To compare the retromandibular anteroparotid approach, retromandibular transparotid approach and high subangulomandibular approach for Mandibular Subcondylar Fractures Fixation

3. MATERIALS AND METHODS:

For a duration of nine months, 33 participants who reported to the Department of Faciomaxillary Surgery at the Sanjay Gandhi Institute of Trauma and Orthopaedics in Bengaluru participated in a clinical prospective comparative study. Patients who were willing to participate in the study and had subcondylar fractures that were recommended for open reduction and internal fixation with miniplates and screws were included. Patients who had comminuted and subcondylar fractures, facial nerve injuries, pregnancies, medically impaired conditions, or those patients who were unable to attend follow-up were excluded from the study.

Based on the predictor variable—the surgical approach to be employed for ORIF—the patients in the three groups were randomly assigned using a stratified computer-generated random number table.

Group A: Retromandibular Anterior Parotid (RMTMAP) approach
Group B: Retromandibular transparotid (RMTP) approach
Group C: High Subangulomandibular Approach

Surgical technique:

Chlorhexidine and 5% betadine were used to prepare the skin, and the patient was draped so that the ear was exposed till the corner of the mouth on the side that would be operated. Skin incisions and anatomical markers were indicated. In every instance in either group (Groups A and B), the skin incision was maintained 0.5 cm below the ear lobe and 3–4 cm long, directly posterior and parallel to the mandibular posterior border. Following a skin incision, the parotid capsule was reached by dissecting the subcutaneous tissue and cutting through the thin layer of platysma. Depending on the randomization group (Groups A and B), additional dissection was performed approach wise when the parotid capsule was exposed.

To reach the anterior border of the parotid gland, dissection was carried anterosuperiorly in the plane of the parotid capsule using the Retromandibular Anteroparotid approach. Following the identification of the parotid gland's anterior margin, the masseter muscle was revealed by incising the parotid fascia and retracting the gland posteriorly. Dissection was done through masseter muscle along the direction of facial nerve branches to reach the underlying periosteum using bipolar cautery. An incision on the periosteum was placed followed by subperiosteal dissection to expose the fracture location.

The Retromandibular Tranparotid approach involved blunt dissection through the parotid gland's substance parallel to the expected direction of facial nerve branches after the parotid capsule was exposed, with extra caution to prevent damage to the facial nerve branches. Following the dissection and retraction of the parotid gland, the posterior boundary of the ramus was located, and the underlying pterygomasseteric sling was incised using bipolar cautery to reveal the underlying bone. Subperiosteal dissection and fracture site exposure were then performed.

The high subangulomandibular approach has been derived from the Risdon or low subangulomandibular approach. It was initially reported as a surgical procedure by Meyer et al. (21) in 2006. This approach's key features include: a higher incision at 01 cm from the edge of the mandibular angle and a shorter one at 04 cm; a strict ascending subcutaneous dissection that preserves the facial nerve's marginal branch; an oblique SMAS incision at 03 cm from the mandibular angle; confirmation of the presence of the facial nerve branches at the level of the masseter muscle's aponeurosis; and a sectioning of the masseter muscle

on the same oblique line that reveals the posterior edge of the ramus, making it easier to expose the condyle and perform osteosynthesis using 3D plates (3,20).

Interpretation of Data:

Facial Nerve Injury - House Brackmann Scale

Sialocele Formation - Present or Absent (Presence or absence of sialocele was determined by history and clinical examination, nature of the aspirated fluid, and laboratory findings of more than 10,000 U/L of salivary amylase in the aspirated fluid. Surgical site infection was considered to be present if infection occurred near or at the incision site and/or deeper underlying tissue spaces and organs within 30 days of a surgical procedure).

Scar Formation - Scar Cosmesis Assessment and Rating (SCAR Scale)

Statistical Analysis:

Comparison of Incidents of Facial Nerve Injury between different time intervals in each group was done using Cochran's Q Test and McNemar's Post hoc Test.

Sialocele formation between three groups at different post-operative time intervals were analysed using Chi-square Test.

Comparison of Mean SCAR Scale score were analysed using KruskalWallis test followed by Dunn's Post Hoc Test and comparison of Mean scar esthetic scores between different time intervals in each group using Friedman's Test.

4. RESULTS:

In our study, incidence of Facial Nerve Injury was the highest in Group B (Retromandibular Tranparotid Approach) with 4 out of 11 patients having grade II (House-Brackman grading system) transient facial nerve palsy. The lowest incidence was observed in Group A (Retromandibular Anteroparotid Approach) with only 1 out of 11 patients which resolved within post-operative one week whereas Group C (High subangulomandibular Approach) had an incidence of 2 out of 11 patients. On comparison of the incidence of Facial nerve injury between different time intervals in each group using Cochran's Q Test, it was observed that the incidence of Facial Nerve Injury was 9.1 % in Group A; 36.4 % in Group B, and 18.2 % in Group C on Day 1. It resolved in all the groups within a week except for Group B, where it persisted at 9.1 %. And it completely resolved amongst all the groups within a month. Statistically significant results were obtained for Group B with p value of 0.02. While doing multiple comparisons of Facial nerve injury between different time intervals in Group B using McNemar's Post hoc Test, statistically significant

results were obtained for post operative day 1 vs post operative M1 and post operative D1 vs post operative M3 with the p-value of 0.04 in both of them. From the results,
it's evident that most number of Facial Nerve Injury was observed when Transparotid approach was employed and the Least number of Facial Nerve was observed when Anteroparotid approach was employed. The temporal, zygomatic, and buccal branches were the most commonly injured branches. All of them recovered within a month postoperatively. When any branch of the FN was encountered, it was dissected free for 1 cm posteriorly and 2 cm anteriorly, allowing it to be retracted away from the surgical site. When not directly visible, facial nerve injury can be attributed to the traction of the tissues. No permanent facial nerve palsy was observed in the study.

On comparison of mean scar aesthetic score between three groups at different time intervals using Kruskal Wallis Test followed by Dunn's Post hoc Test, the mean value on Day 1 of Scar Scale Scores were 1.45 for Group A; 2.36 for Group B and 2.45 for Group C with the min and Max value ranging from 1-2,2-3 and 2-3 respectively. The result was statistically significant with a p-value of 0.001. The comparison of the SCAR score of Group B and Group C with Group A was statistically significant with p-values of 0.002 and 0.001 respectively. The mean value on Post-Operative Month 1 was 0.73 for Group A; 1.00 for Group B and 1.00 for Group C with the minimum and maximum values ranging from 0-1,1-1 and 1-1 respectively. The result was statistically significant with p value of 0.04. The comparison of the scar score of Group B and Group C with Group A was statistically significant with p value of 0.04 for both of them. On comparison of Mean scar esthetic scores between different time intervals in each group using Friedman's Test, a statistically significant result was obtained with p value of <0.001 in all the groups. Similarly, statistically significant results were majorly obtained on multiple comparison of scar aesthetic scores between different time intervals in each group using Wilcoxon Signed Rank Post hoc Test.

On comparison of the incidence of sialocele Formation between 3 groups at different post-operative time intervals using Chi-Square Test, the incidence of sialocele Formation was present in 27.3% for Group A; 45.5% for Group B and Nil for Group C with a statistically significant result (p-value of 0.04) on Post Operative Day 1. It resolved for Group A within a week but for Group B it persisted with 36.4% with a statistically significant result (p-value of 0.01).However, it resolved completely within postoperative one month. On, multiple comparisons of proportional difference in the incidence of sialocele formation between different groups at Postoperative Day 1 and Week 1 interval using Chi-Square Test resulted in majorly statistically significant result.

5. DISCUSSION:

Even the most skilled surgeons face a number of difficulties when treating condylar fractures openly (1). Surgery is now the recommended course of treatment, particularly for fractures of the medial or low condylar bones. Three rules must be followed for surgical repair of condylar fractures: precise reduction, reliable fixation, and minimal damage - the choice of approach being the first issue (2). The choice of a particular technique to reach the condyle fracture relies on its location and the kind of osteosynthesis envisaged (straight mini-plates or 3D plates) (3). For the purpose of fixing mandibular subcondylar fractures and the related complications of scar aesthetics, sialocele formation, and facial nerve injury, we compared the retromandibular anteroparotid, retromandibular transparotid, and high subangulomandibular approaches.

While comparing the facial nerve injury for different approaches in our study, the temporal, zygomatic and buccal branches were most commonly injured. Contrary to this, the studies done by Hyde et al. (2002), Vesnaver et al. (2005), Downie et al. (2009), Bhutia et al. (2014) and Shi et al. (2014) all reported injury to the buccal branch majorly. On the other hand, Ellis and Dean (1993) and Manisali et al. (2003) discovered that the most commonly impacted branch was the marginal mandibular nerve. Because the dissection is performed superomedially toward the fractured condyle and entails retraction of the soft tissues, including the buccal branches, in a superior and anterior direction, the buccal branch may have been more severely impacted (4-6).

Although facial nerve fibers are not often visible, when they are, they should be carefully conserved and shielded using a retractor. Problems with surgical damage or a reduction in the nerve's blood supply may be avoided since the solitary branches are left implanted in the surrounding connective tissue. However, the required soft tissue retraction following surgery may result in transient palsy (7–11).

We had the maximum incidence of transient facial nerve palsy via retromandibular transparotid approach followed by a high subanglomandibular approach and the minimum in the retromandibular anteroparotid approach. None of them were permanent facial nerve palsy. Sikora et al. (12), Girotto et al. (13), and Ghezta et al. (14), all reported similar results of temporary facial nerve palsy following the RMTP method. They were all temporary injuries to the facial nerves. The surgical access passes through the parotid gland, where soft tissues and facial nerve branches are retracted, which may cause temporary neuropraxia that results in facial palsy. This is the reason for the high frequency of FN injuries.Similarly,

writers such as Shi et al., Downie et al., Narayan et al., Kim et al. (15), and Manisali et al. (16) did not report any cases of permanent facial nerve palsy following the RMTP.

Several authors have described the complication of a salivary fistula or sialocele following aretromandibular transparotideal approach (Mandal et al, Hou J et al, Handschelet al, Downie et al, Narayan et al, Sikora et al, Kim et al, Ellis et al (17); Vesnaver et al (18) ; Kannon et al (19)).
Similarly, out of 11 cases for the retromandibular transparotid approach in our study, we had 5 cases of sialocele formation. In contrast, the study conducted by Girotto et al. and Ghezta et al. did not observe any sialocele formation even in the transparotid approach.

Scar Esthetics in our study were more aesthetic for the retromandibular anteroparotid approach as compared to retromandibular transparotid approach and high subanglomandibular approach.
Studies by Hou J et al., Kaouani A et al., Biglioli et al., Narayan et al., Vesnaver et al., and Kanno et al. showed minimal to undetectable post-operative scarring in their respective approaches. However, the scar aesthetics weren't very good in studies by Mandal et al., Handschel et al., Kumaran et al., Kim et al., Minasali et al., Ellis et al., and Louvrier et al., citing a small number of hypertrophic scars as well post their respective approaches.

In their respective studies done by Kaouani et al.(3) and Louvrier A et al. (20), they fixed sub-condylar fractures using a high subangulomandibular incision. A variation of the Risdon or low subangulomandibular method is the high subangulomandibular approach. By taking this route, the patient avoids the risks of issues associated with parotid gland involvement that come with other methods, such as salivary fistula, sialoceles, or Frey syndromes. Thus, that explains why there was no occurrence of sialocele in their investigation. There was very little to no occurrence of temporary facial injuries, and those that did occur recovered well over time. Because they were located in a shadowed area and a natural crease, right beneath the mandibular angle's relief and parallel to Langer's lines, skin scars were typically considered quite acceptable (3,20). On the contrary via the same approach, the scar esthetics weren't that good in our study. As expected, there were no cases of sialocele formation. There were 2 cases of transient facial nerve injury out of 11 cases that subsided within a week, similar to the former studies.

6. CONCLUSION:

In conclusion, Group B patients had the higher incidence of Facial Nerve Injury and Sialocele Formation whereas the incidence of Scar Esthetics were almost similar in Group B and Group C. Also, the

accessibility of the fracture site with the high subanglomandibular approach was an issue hence it's choice should be preferred only for low subcondylar fracture fractures rather than high subcondylar fractures.

7. ETHICS STATEMENT/CONFIRMATION OF PATIENTS' PERMISSION:

Ethical clearance was obtained by the Institutional Ethics Committee at SGITO, Bengaluru. All patients gave written consent to their inclusion in the study.

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TABLE NO. 1 AND BAR CHART NO. 1

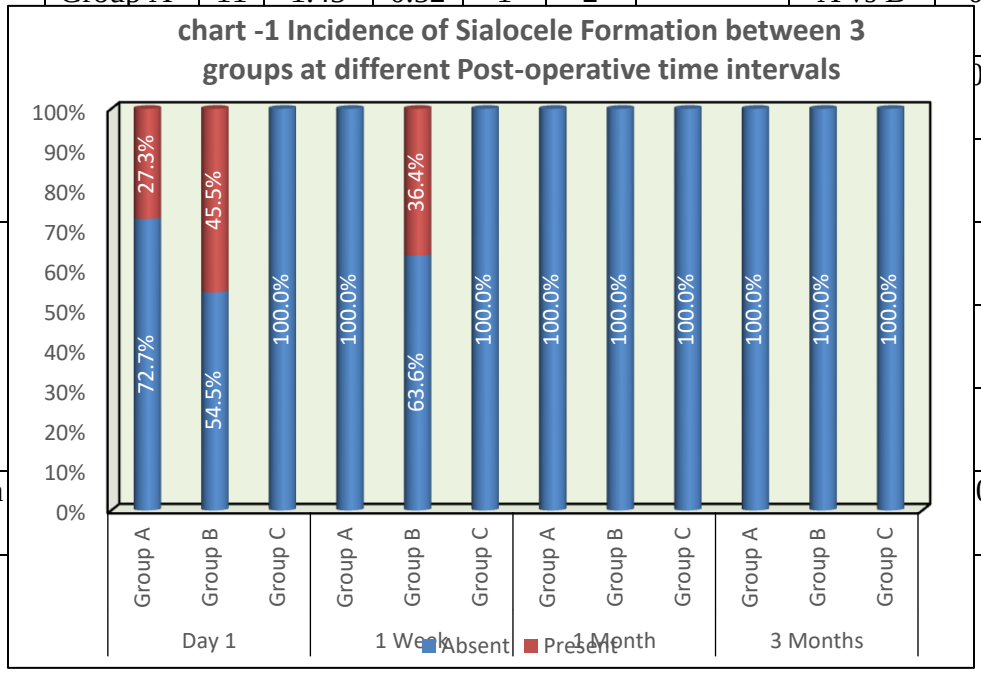
Comparison of Incidence of Sialocele Formation between 3 groups at different Post-operative time intervals using Chi Square Test								
Time	Grades	Group A		Group B		Group C		p-value
		n	%	n	%	n	%	
Day 1	Absent	8	72.7%	6	54.5%	11	100.0%	0.04*
	Present	3	27.3%	5	45.5%	0	0.0%	
1 Week	Absent	11	100.0%	7	63.6%	11	100.0%	0.01*
	Present	0	0.0%	4	36.4%	0	0.0%	
1 Month	Absent	11	100.0%	11	100.0%	11	100.0%	..
	Present	0	0.0%	0	0.0%	0	0.0%	
3 Months	Absent	11	100.0%	11	100.0%	11	100.0%	..

	Present	0	0.0%	0	0.0%	0	0.0%	

* - Statistically Significant

TABLE NO. 2

Comparison of mean Scar Aesthetic scores b/w 3 groups at different time intervals using Kruskal Wallis Test followed by Dunn's Post hoc Test									
Time	Groups	N	Mean	SD	Min	Max	p-value [a]	Sig. Diff	p-value [b]
Day 1	Group A	11	1.45	0.52	1	2		A vs B	0.002*
									0.001*
									0.67
1 Week									0.64
									0.35
									0.66
1 Month									0.04*



	Group B	11	1.00	0.00	1	1		A vs C	0.04*
	Group C	11	1.00	0.00	1	1		B vs C	1.00
3 Months	Group A	11	0.27	0.47	0	1	0.87	A vs B	0.66
	Group B	11	0.36	0.51	0	1		A vs C	1.00
	Group C	11	0.27	0.47	0	1		B vs C	0.66

* - Statistically Significant

Note: a. Kruskal Wallis Test & b. Dunn's Post hoc Test

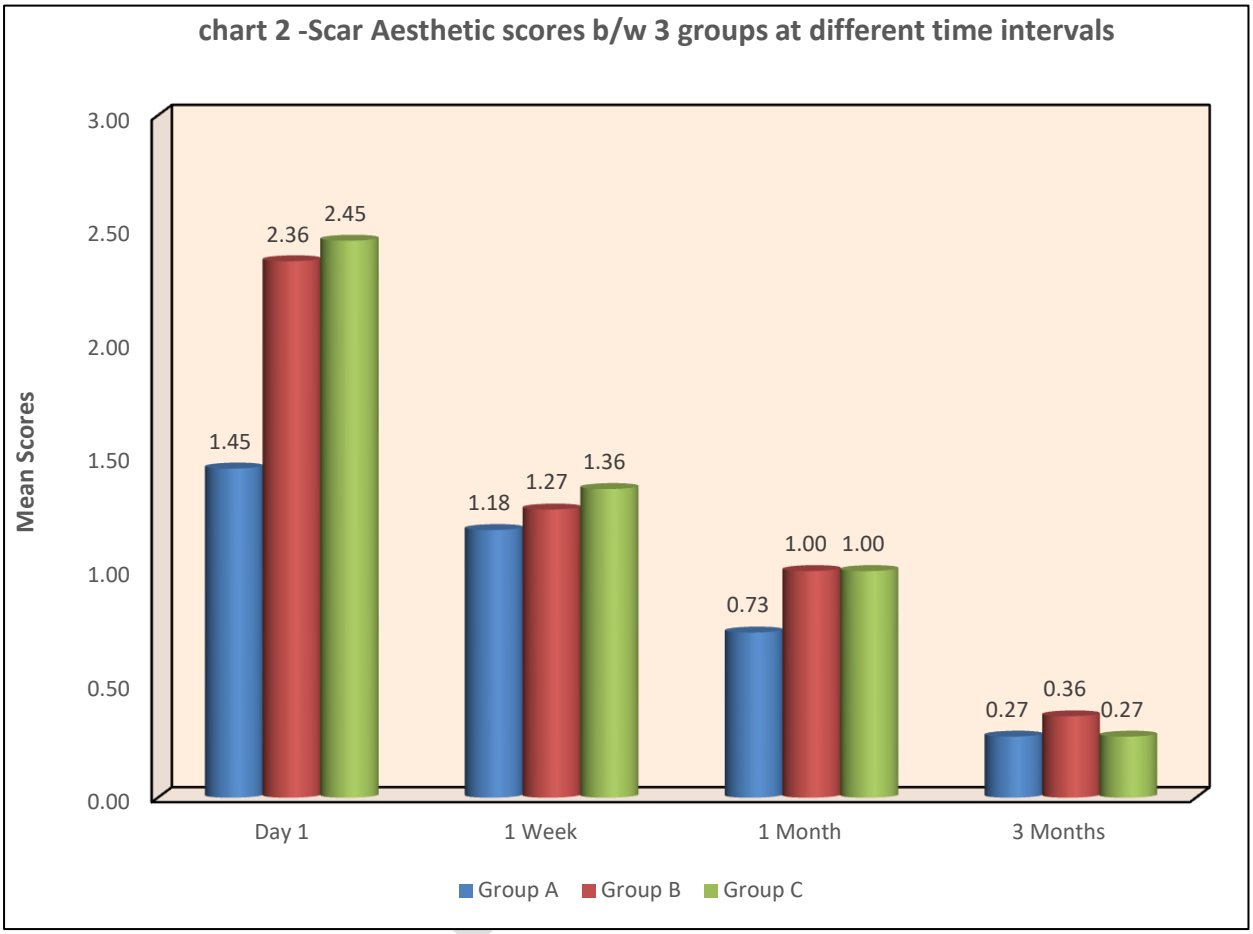


chart 2 -Scar Aesthetic scores b/w 3 groups at different time intervals
Mean Scores
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1.45
2.36
2.45
1.18
1.27
1.36
0.73
1.00
1.00
0.27
0.36
0.27
Day 1
1 Week
1 Month
3 Months
Group A
Group B
Group C

TABLE NO. 3

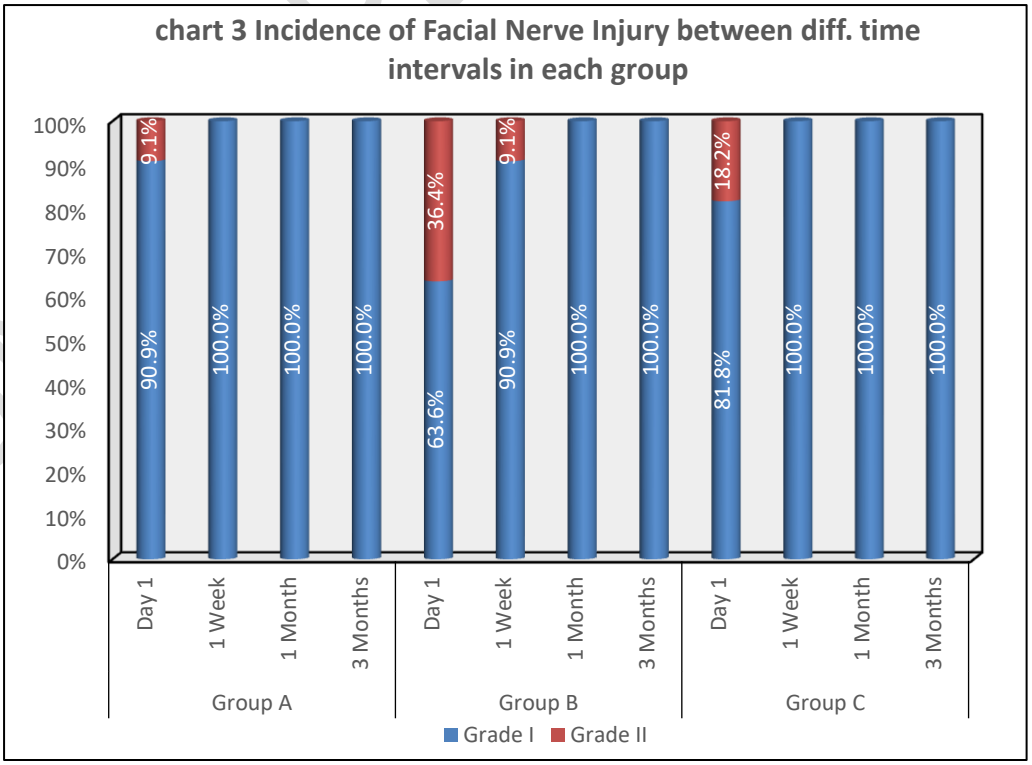
Comparison of mean Scar Aesthetic scores b/w different time intervals in each group using Friedman's Test							
Groups	Time	N	Mean	SD	Min	Max	p-value
Group A	Day 1	11	1.45	0.52	1	2	<0.001*
	1 Week	11	1.18	0.41	1	2	
	1 Month	11	0.73	0.47	0	1	
	3 Months	11	0.27	0.47	0	1	
Group B	Day 1	11	2.36	0.51	2	3	<0.001*
	1 Week	11	1.27	0.47	1	2	
	1 Month	11	1.00	0.00	1	1	
	3 Months	11	0.36	0.51	0	1	
Group C	Day 1	11	2.45	0.52	2	3	<0.001*
	1 Week	11	1.36	0.51	1	2	
	1 Month	11	1.00	0.00	1	1	
	3 Months	11	0.27	0.47	0	1	

* - Statistically Significant

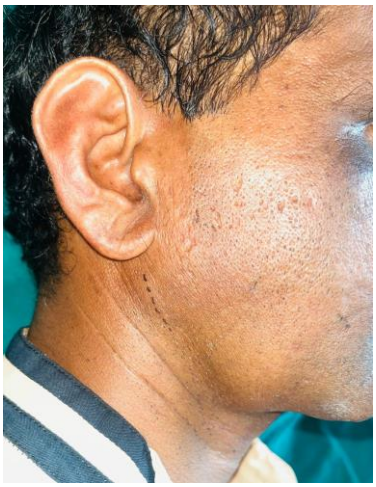
TABLE NO. 4

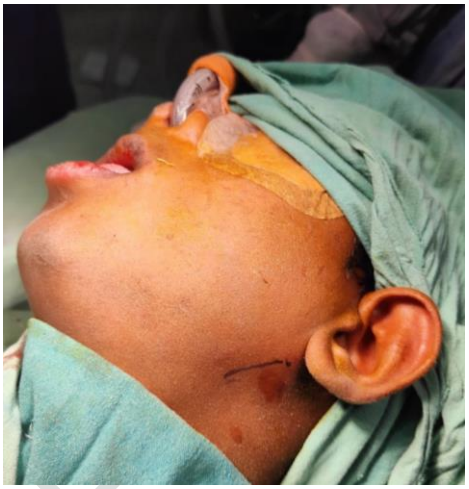
Comparison of Incidence of Facial Nerve Injury between diff. time intervals in each group using Cochran's Q Test										
Groups	Grades	Day 1		1 Week		1 Month		3 Months		p-value
		n	%	n	%	n	%	n	%	
Group A	Grade I	10	90.9%	11	100.0%	11	100.0%	11	100.0%	0.39
	Grade II	1	9.1%	0	0.0%	0	0.0%	0	0.0%	
Group B	Grade I	7	63.6%	10	90.9%	11	100.0%	11	100.0%	0.02*
	Grade II	4	36.4%	1	9.1%	0	0.0%	0	0.0%	
Group C	Grade I	9	81.8%	11	100.0%	11	100.0%	11	100.0%	0.11
	Grade II	2	18.2%	0	0.0%	0	0.0%	0	0.0%	

* - Statistically Significant

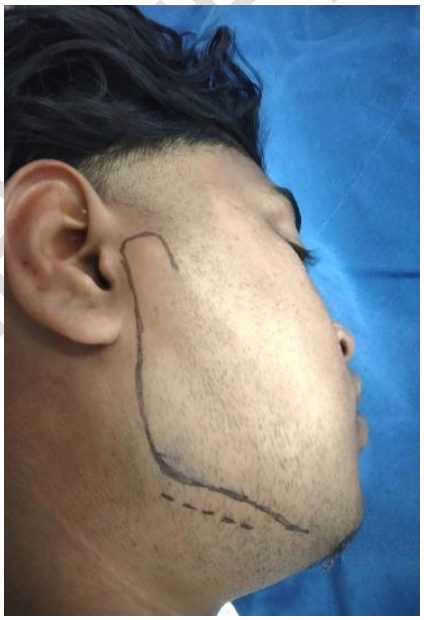


. **Fig 1: THE APPROACHES**



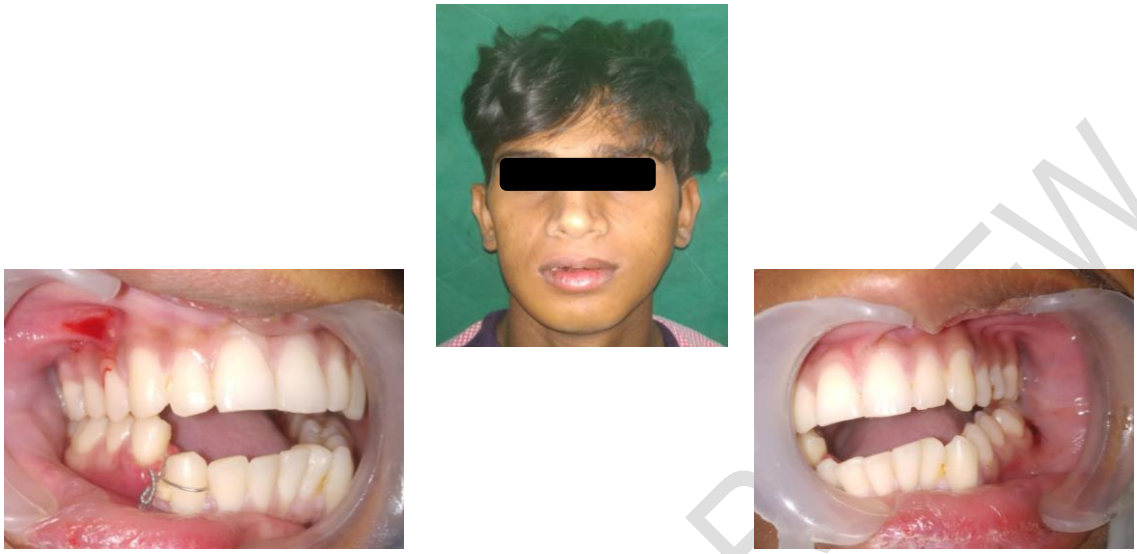


Retromandibular incision marked on both patients via which we can approach the fracture either via anteroparotid or transparotid.



High Subanglomandibular approach marking on the patient

Fig. 2 : PREOPERATIVE PHOTOGRAPHS



PREOPERATIVE CT SCAN

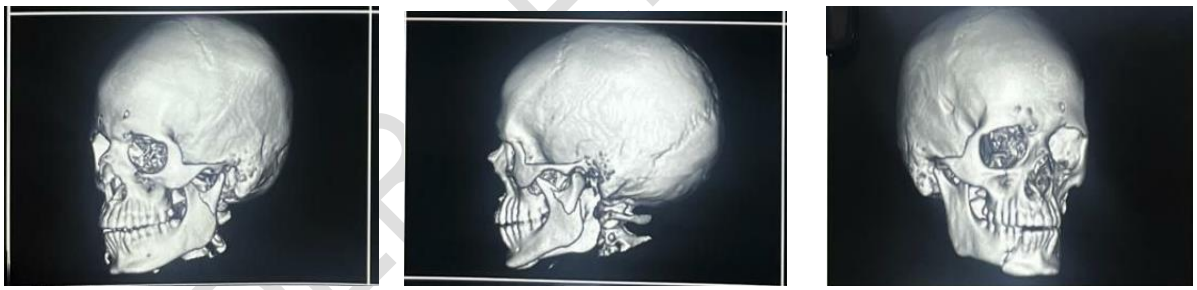
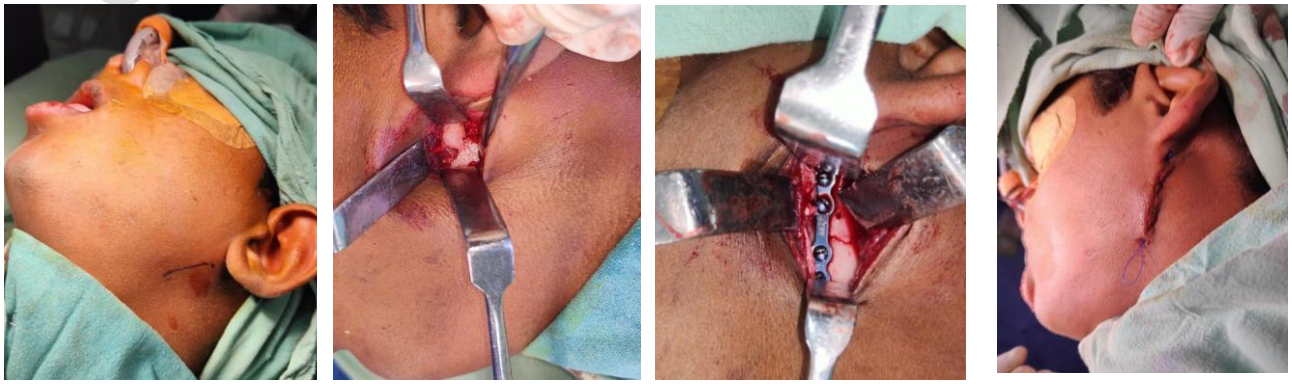
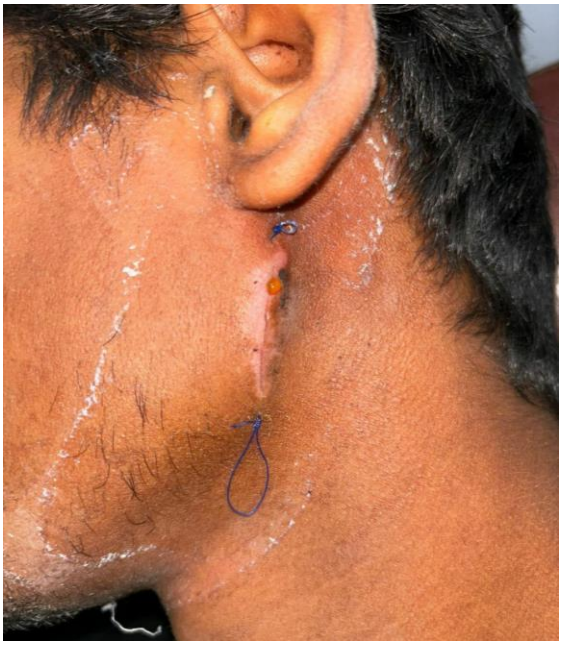
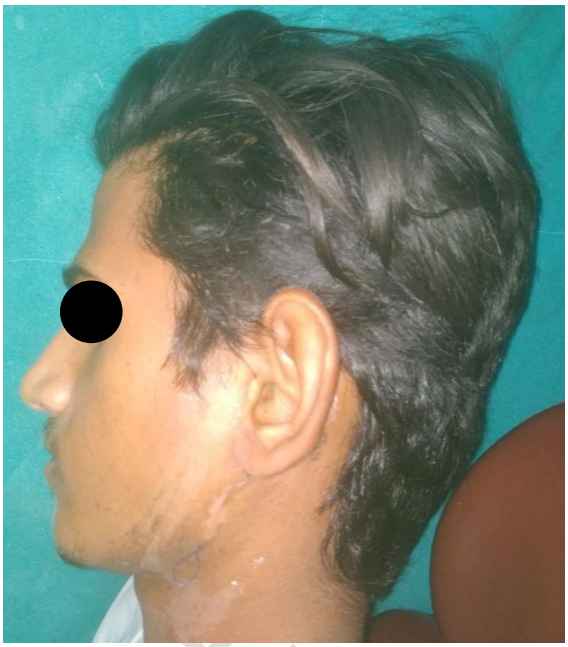


Fig. 3 : INTRAOPERATIVE PHOTOGRAPHS OF RETROMANDIBULAR TRANSPAROTID APPROACH

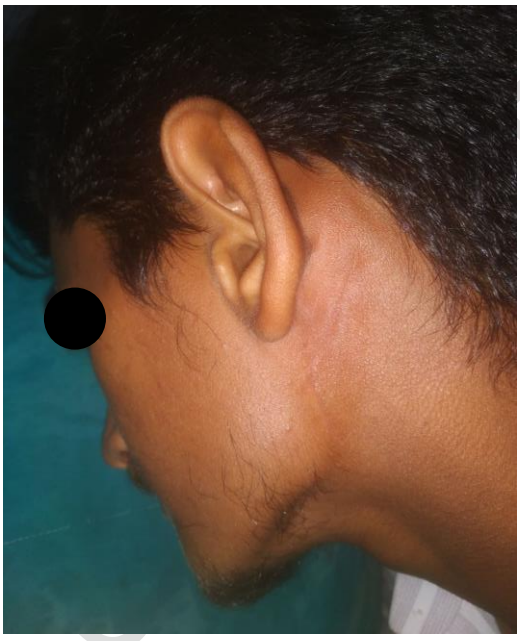




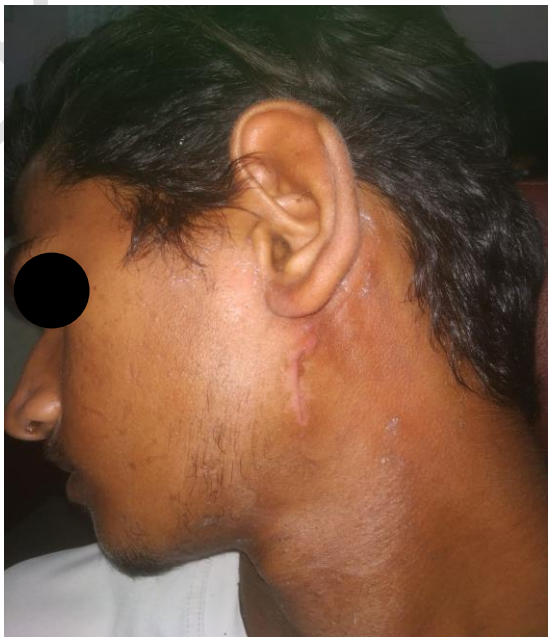
POST OPERATIVE DAY 2



POST OPERATIVE DAY 7



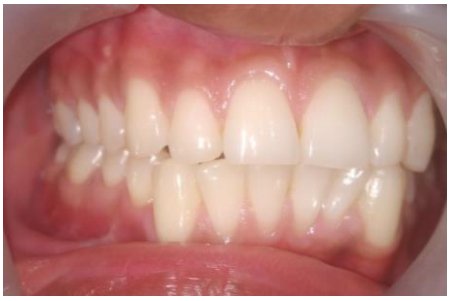
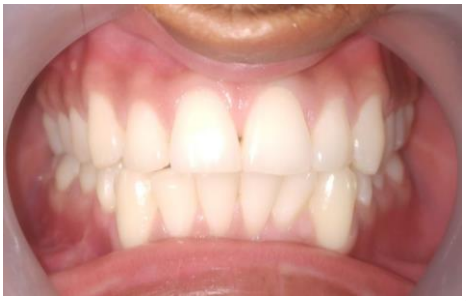
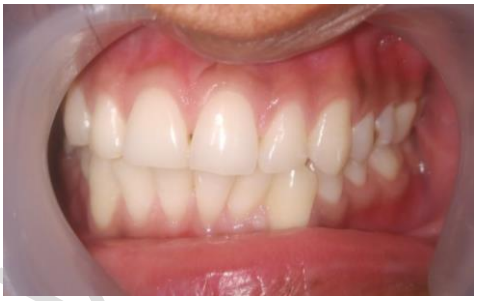
POST OPERATIVE MONTH ONE



POST OPERATIVE DAY 10

Fig. 4: SIALOCELE FORMATION AND SCAR ESTHETICS

Fig. 5: POST-OPERATIVE PHOTOGRAPHS

IMMEDIATE POST-OPERATIVE RADIOGRAPH

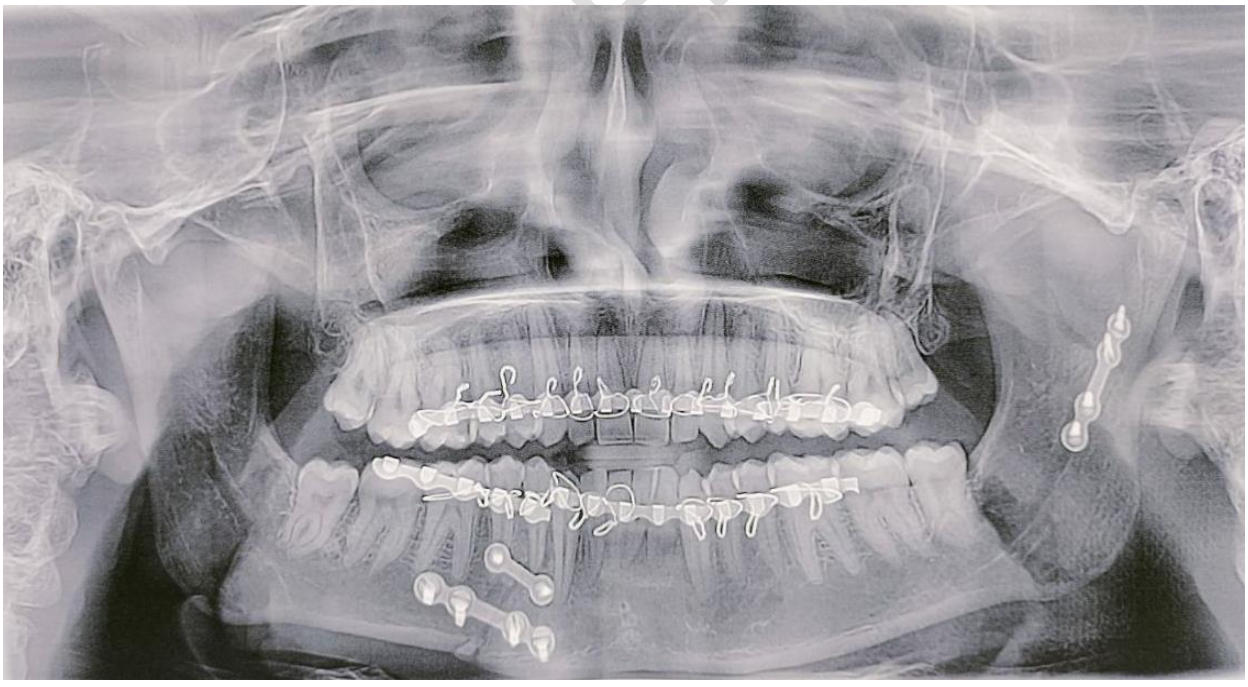
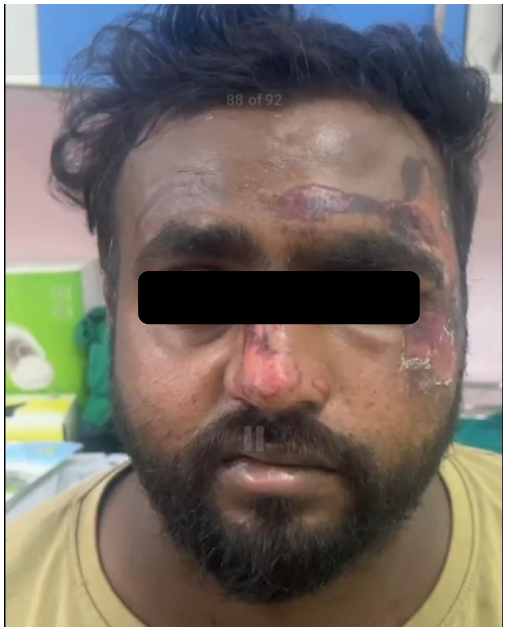


Fig. 6: FACIAL NERVE EXAMINATION

There wasn't any facial nerve injury in this case of Retromandibular Transparotid Approach

Fig. 7: FACIAL NERVE PALSY



House–Brackman grading system for facial nerve injury assessment.

Grade	Description	Characteristics
I	Normal	Normal facial function in all nerve branches.
II	Slight	Gross Slight weakness on close inspection, slight synkinesis. At rest Normal tone and symmetry. Motion Forehead: Good to moderate movement. Eye: Complete closure with minimum effort. Mouth: Slight asymmetry.
III	Moderate	Gross Obvious but not disfiguring facial asymmetry. Synkinesis is noticeable but not severe. May have hemi-facial spasm or contracture. At rest Normal tone and symmetry. Motion Forehead: Slight to moderate movement. Eye: Complete closure with effort. Mouth: Slight weakness with maximum effort.
IV	Moderately severe	Gross Asymmetry is disfiguring and/or obvious facial weakness. At rest Normal tone and symmetry. Motion Forehead: No movement. Eye: Incomplete eye closure. Mouth: Asymmetrical with maximum effort.
V	Severe	Gross Only slight, barely noticeable, movement. At rest Asymmetrical facial appearance. Motion Forehead: No movement. Eye: Incomplete closure. Mouth: Slight movement.
VI	Total	No facial function

TABLE 5 : HOUSE BRACKMAN GRADING SYSTEM

Shi D, Patil PM, Gupta R. Facial nerve injuries associated with the retromandibular transparotid approach for reduction and fixation of mandibular condyle fractures. Journal of Cranio-Maxillofacial Surgery. 2015 Apr 1;43(3):402-7.

Clinician Items	Scale Ratings
Scar spread	0, None to near-invisible
	1, Pencil-thin line
	2, Mild spread, noticeable on close inspection
	3, Moderate spread, obvious scarring
	4, Severe spread
Erythema	0, None
	1, Light pink, some telangiectasias may be present
	2, Red, many telangiectasias may be present
	3, Deep red or purple
Dyspigmentation (includes hyperpigmentation and hypopigmentation)	0, Absent
	1, Present
Track marks or suture marks	0, Absent
	1, Present
Hypertrophy/atrophy	0, None
	1, Mild: palpable, barely visible hypertrophy or atrophy
	2, Moderate: clearly visible hypertrophy or atrophy
	3, Severe: marked hypertrophy or atrophy or keloid formation
Overall impression	0, Desirable scar
	1, Undesirable scar
Patient items	
Have you been bothered by any itch from the scar in the past 24 h?	0, No
	1, Yes
Have you been bothered by any pain from the scar in the past 24 h?	0, No
	1, Yes
Total score range	0 (best possible scar) to 15 (worst possible scar)

TBALE 6 : THE SCAR COSMESIS ASSESSMENT AND RATING (SCAR) SCALE

Kantor J. Reliability and photographic equivalency of the Scar Cosmesis Assessment and Rating (SCAR) Scale, an outcome measure for postoperative scars. Jama Dermatol. 2017;153(1):55–60.