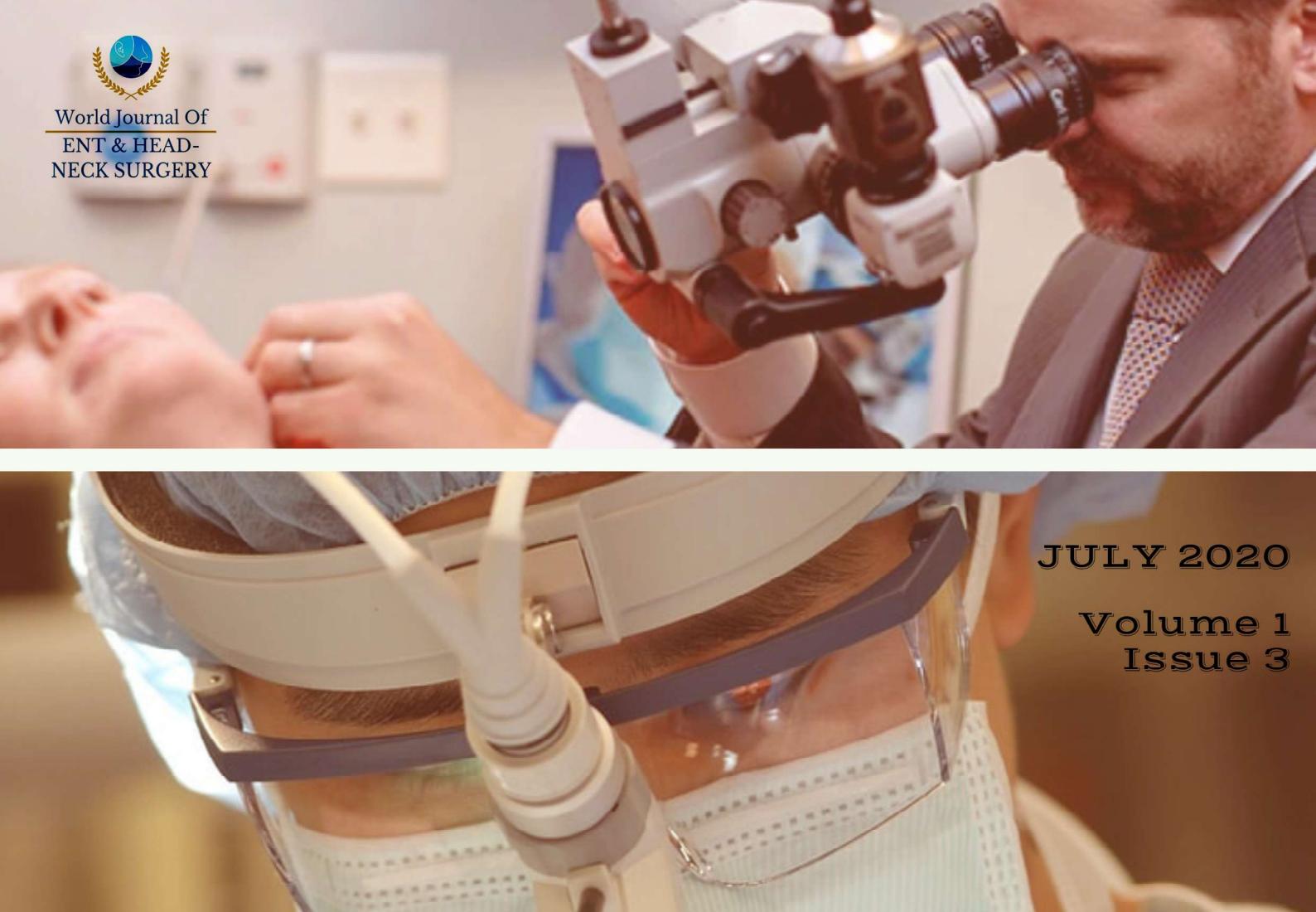




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# WORLD JOURNAL OF ENT AND HEAD-NECK SURGERY

Official Publication of Chittaranjan  
Otorhinolaryngologists Society



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Volume 1, Issue 3, July 2020

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## RESIDENT TRAINING DURING COVID-19 PANDEMIC

We find ourselves in a precarious condition, amidst unprecedented times. Ever since the last edition of this journal, the number of cases in the country has been exponentially rising. Perhaps the most unsettling aspect of the entire situation and indeed one which is most worrisome, is the fact that, as a community, we are yet to reach a peak in the number of cases. As bleak as it may sound, the worst has not yet arrived.

Recent studies documenting the isolation of SARS-CoV-2 virus from the mastoid and middle ear as well as studies showing Otolaryngologists to be the medical specialists most vulnerable to contracting Coronavirus, have only added to the gloom engulfing our fraternity.

Otolaryngology Residents throughout the country are being adversely affected. Several residents belonging to the outgoing batches of their respective departments, have had their exams delayed endlessly. In rare cases where exams have been conducted, they have been done in a makeshift way, with the addition of several virtual components, depriving Residents of an opportunity to showcase the knowledge that they have acquired with such difficulty. Many Residents are being posted to COVID-designated hospitals, where the specialist knowledge and skills which they have laboriously cultivated over their tenure will not be put to appropriate use.

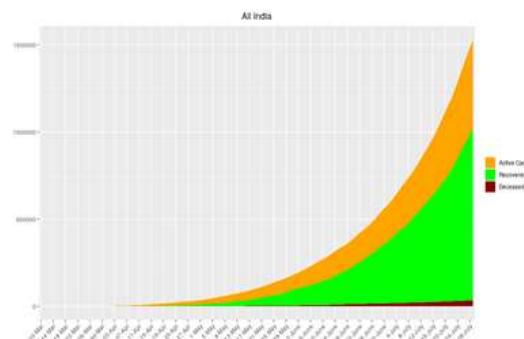
With admissions delayed across the country, the incoming batch of Residents are also facing difficulty in joining their newly allotted Institutes. The transport and travel bans throughout the country have done little to alleviate the logistical problems that they are facing.

Perhaps the worst affected are the batches of Residents who are currently undergoing training. Bereft of the opportunity to operate on a wide assortment of cases, owing to the ongoing crisis, they find themselves losing out on the most fertile period of their learning process. Many Residents aren't being able to do justice to their talents, as there energy and time are being diverted in fighting this deadly virus. Data collection for thesis cases has also suffered.

The solution lies in endeavouring to continue their learning process amidst this crisis. In the absence of routine cases, the Residents can work on other aspects of their development, and seek to bolster their theoretical knowledge. Regularly organized Webinars have proved to be a boon to this effect. Deprived of elective operations, the Residents can seek to increase practical understanding and surgical skills through cadaver dissections.

With each passing day, it seems increasingly inevitable that in the foreseeable future, we shall have to live with this deadly virus amidst us. With this realization, perhaps it will be better to not stop the routine care for the non-COVID patients. We must take active steps to try and restore normalcy in the training of our Residents. However, utmost importance must be given to adequate protection at all times.

In this bleak setting, the allure of cataclysmic thinking is often too strong to resist. Yet, we must remain optimistic and hope that we can emerge from this global contagion, unscathed and stronger.



Prof. Dr Somnath Saha  
Editor In Chief

# MAXILLO-MANDIBULAR ADVANCEMENT FOR OBSTRUCTIVE SLEEP APNOEA

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## Abstract:

Maxillomandibular advancement (MMA) is a novel technique which treats obstructive sleep apnea by actual increment of retropalatal and retrolingual space and tightening the lateral pharyngeal wall. We have performed MMA in 5 patients with severe sleep apnea. Among them 2 had undergone previous soft tissue surgery with persistent OSA and 3 were offered MMA as first line of treatment after CPAP failure and/or noncompliance. All patients showed symptomatic improvement in respect of snoring, quality of sleep and excessive day time sleepiness. All of them achieved reduction of Apnea Hypopnea Index (AHI) by 50% and improvement in Lowest Oxygen Saturation Index (LSAT). For 3 patients AHI came down below 5. There was no postoperative complications.

**Keywords :** Sleep Apnea, MMA, Maxillo Mandibular Advancement, Surgery

## Introduction

Obstructive sleep apnoea (OSA) is a common disorder characterized by the repetitive complete or partial collapse of the upper airway during sleep.

It results in intermittent hypoxaemia and hypercapnia, cortical arousals and surges of sympathetic activity. Pathophysiology of obstructive sleep apnea is complex. There is interplay between anatomical static and dynamic obstruction.

Soft tissue procedures involving palate, uvula, tongue base gives promising result in most of the cases. But patients with obvious midface or lower face deformity do not improve only from soft tissue surgery. These cases require bony procedures.

Maxillo-Mandibular Advancement (MMA) is one of the most effective surgery for these patients<sup>1</sup>. MMA achieves enlargement of the nasopharyngeal, retropalatal, and hypopharyngeal airway by expanding the facial skeletal framework via Le Fort I maxillary and sagittal split mandibular osteotomies.

Advancements of the maxilla and mandible increase tension on the pharyngeal soft tissue, thereby enlarging diameter of upper airway in all dimensions.

## Material and Methods:

In last two years we have performed MMA in five patients with OSA. Among them, 2 patients had persistent OSA after phase 1 reconstruction. Others with obvious disproportionate maxilo-mandibular structures were offered for MMA after proper evaluation (picture 1).

Preoperative assessment included polysomnography, ENT and dental examination, drug induced sleep endoscopy and radiological assessment. Each patient was asked to fill up a questionnaire for assessment of day time sleepiness and quality of sleep. We used Epworth Sleepiness scale (ESS) and Pittsburg Sleep quality Index (PSQI) format for this purpose.

This was repeated after 2 months from surgery. Radiology included OPG, X-ray skull lateral view (picture 2) and CT scan of nose and paranasal sinuses



Picture 1: patient with severe OSA with small maxilla, underwent MMA

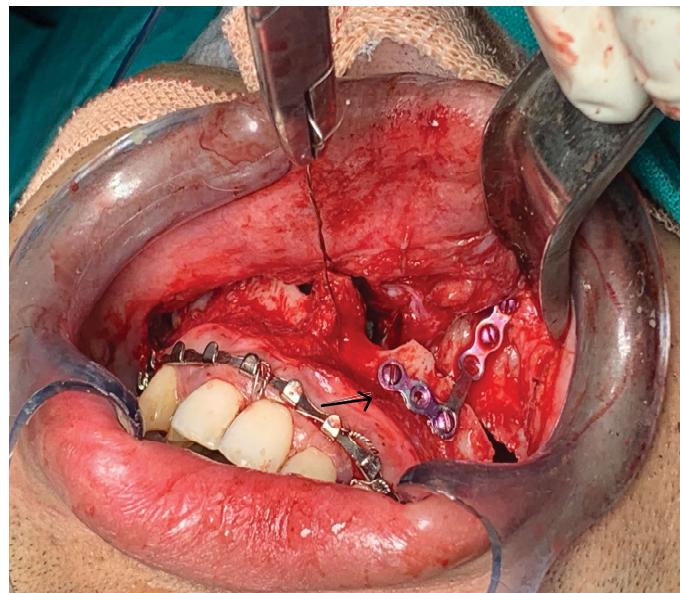


Picture 2: Lateral view Xray Skull showing narrow retromaxillary and retroolingual space

Drug induced sleep endoscopy was combined with Esmach's maneuver to assess expected improvement in airway during mandibular advancement and also to rule out global hypotonia of airway musculature. Surgery was performed with maxillofacial team

Dental work was done in advance one day before the surgery.

Local infiltration of 2% xylocaine with 1:80,000 adrenaline was given in oral mucosa. An upper buccal sulcus incision was given in the maxilla. Standard le fort 1 osteotomy cuts were made. Following pterygomaxillary dysjunction the maxilla was downfractured and mobilised . The maxilla was then advanced by approximately 10mm and fixation was carried out with miniplates in the pyriform area and buttress area (picture 3).



Picture 3: Maxillary Le forte 1 osteotomy, maxillary advancement (black arrow)

A buccal mucoperiosteal flap was elevated in the posterior mandible. Standard saggital split osteotomy cuts were made in the medial ramus, buccal shelf and a vertical cut in the body of the mandible. A saggital split was carried out taking care to preserve the inferior alveolar neurovascular bundle. Following the split the maxillomandibular fixation was done and miniplates used to fix the mandible. An anterior labial sulcus incision was made in the mandible for access to the bony chin and a advancement genioplasty was carried out followed by fixation (picture 4).



Picture 4: Surgical step showing Maxillary Advancement

At the end of the surgery the maxillomandibular fixation was removed.

Details of each case is depicted in table 1

Case	Phase 1 Surgery	Phase 2 Surgery
1	Nil	Septoplasty, turbinoplasty, MMA
2	Nil	Septoplasty, turbinoplasty, conchoplasty, MMA
3	Nil	Uvuloplasty, turbinoplasty, MMA
4	UPPP, septoplasty	MMA
5	UPPP, advancement genioplasty	MMA

Table 1: Surgical Procedure Details

Average postoperative hospital stay was 3 days with intravenous medication.

Only for one patient we performed preoperative tracheostomy to prevent desaturation from postoperative oedema because of very high AHI (67) and obesity. Tracheostomy was removed after 48 hours.

All other patients were managed in SICU for first 24 hours with head end inclined 30 degree. Intravenous steroid was given for 48 hours to prevent immediate desaturation caused by upper airway oedema. Narcotic analgesic was carefully avoided as per the practice protocol for any surgery in OSA patients. Pain management was done with paracetamol infusion. Strict monitoring was maintained after shifting to ward.

Haemostasis was given utmost importance to prevent aspiration of blood from osteotomy site or formation of haematoma. Meticulous oral and nasal suction was given from 2nd day to prevent nasal synechiae and infection at osteotomy sites. Patients were advised for weekly visit in ENT clinic as well as maxillofacial clinic for first one month. After 3 weeks the heavy rubber bands are changed to lighter ones depending on the occlusion. The patient was kept on a fluid diet for the next 3 to 4 weeks till the removal of arch bars. Soft diet was started thereafter and progressed gradually to a normal diet in a month. PSG was repeated after 2 months. ESS and PSQI score was taken at the same time.

## Results:

Four male and one female patient participated in this study. All of them achieved AHI below 20 and 50% reduction of preoperative AHI. For 3 patients AHI came down below 5.

All the patients reported of definite improvement of quality of life, snoring scale and Epworth Sleepiness Scale (ESS) score.

Aesthetic changes were well appreciated by all patients with maxilla-mandibular disproportion.

Among others who were offered stage 2 procedures, one female patient was not happy about the facial morphology after surgery.

Parameters (mean)	Pre-operative	Post-operative
ESS	15	2.8
PSQI	14	3
AHI	44	5.3
LSAT	79	95.4

Table 2: Comparison of preoperative and postoperative parameters

## Discussion:

Orthognathic surgery has been used to treat obstructive sleep apnea (OSA) since the mid-1980s<sup>2</sup>. Tracheostomy was the only curative procedure for severe OSA at that time.

Hence the paper by Riley et al highlighted maxillary, mandibular and hyoid advancement as alternative to tracheostomy. In 1981 Dr. Sullivan introduced Continuous positive airway pressure (CPAP) therapy for OSA<sup>3</sup>. In the same year the Fujita et al published their work on Uvulopalatopharyngoplasty (UPPP). UPPP was the first surgical approach for OSA. Initial few years UPPP showed good results. Later success rate decreased and the surgery was criticised in various papers<sup>4</sup>. Basically UPPP was designed for oropharyngeal obstruction.

Hence patients with hypopharyngeal obstruction did not get adequate result with UPPP.

Thereafter many techniques were introduced to address tongue base and lateral pharyngeal wall collapse. Different modifications of palatal surgery and tongue base reduction procedures showed promising result.

Multilevel surgery involving nose, palate, tongue along with minimal maxillofacial procedures like genioglossus advancement, hyoid advancement<sup>5</sup>. Multilevel approach increased the success rate of OSA surgery. But still none of the procedures have shown cure rate as compared to CPAP. This lacuna was filled by MMA for OSA patients. Though introduced even before UPPP, this procedure was not popular in those days. In current decades more number of cases and long term follow up have shown its superiority than any other single procedure. Current success rate according to PSG is 97 to 100%<sup>6-8</sup>.

Selecting the surgical procedure for OSA patient is the key to surgical success. Riley and Powell proposed a surgical protocol for this<sup>9</sup>. Where in phase 1 was a conservative approach which included UPPP and/or mandibular osteotomy with genioglossus advancement-hyoid myotomy and suspension. Phase 2 was MMA, offered to the patients who did not achieve surgical cure with phase 1. The surgical success rate for the 239 patients treated with phase 1 therapy was 61% (145 patients). Twenty-four patients who failed phase 1 treatment entered phase 2 treatment. The surgical success rate of phase 2 was 100%.

Riley and Powell have shown that 10 mm Advancement of the maxilla and mandible resulted in an impressive 97% cure rate in patients who had failed phase I surgery and 91% in patients treated solely by phase II surgery<sup>10,11</sup>. Airway obstruction in immediate postoperative period may develop from various causes.

Postoperative edema, pooled secretions and accumulated blood are major causes of airway compromise. Though rare, airway obstruction may be life threatening at time s after extubation<sup>12</sup>.

Our case series is small in number. We did not have any complication. Nevertheless vigilant post-operative care is of utmost importance, especially for first two days after surgery.

Review articles and meta-analysis of large number of MMA surgeries have shown 1 % major and 3 % minor complication rates<sup>1</sup>. Among minor complication commonest is temporary paraesthesia of face.

In our experience, it may be little difficult to convince the patients for this surgery; compared to palatal soft tissue surgeries. Aesthetic changes must be informed to the patients beforehand. But compared to soft tissue procedures involving palate, tongue base this surgery is less painful and better tolerated.

All patients were satisfied after surgery in respect of quality of sleep and improvement in day time symptoms. Bed partners were asked about snoring of the patients. Four of them reported no snoring after surgery. One had occasional snoring of low grade but no apnea.

## Conclusion:

Maxillomandibular advancement is an effective surgical option for OSA patients with high success rate and patient satisfaction. It is a safe procedure with short hospital stay.

This can be combined with nasal procedures and in some cases with UPPP or genioglossus advancement to avoid multiple procedures.

In appropriate cases with obvious facial deformity MMA should be offered as first option. This can prevent repeated surgical intervention and undertreating severe OSA cases.

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# MANAGEMENT OF MANDIBULAR FRACTURES: OUR EXPERIENCE

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## ABSTRACT:

**Background:** Mandibular fracture is one of the most common facial bone fractures associated with significant morbidity. Road traffic accidents are one of the leading causes of mandibular fractures. Radiology is an essential component in the workup of mandibular fractures. Fractures can be managed based on the principles of either rigid fixation or adaptive osteosynthesis.

**Aim:** To study the socio-demographic profile, etiology, classification, and postoperative outcome assessment of mandibular fractures at our institution.

**Method:** This is a prospective observational study. It was conducted on all cases of mandibular fractures excluding those with pan-facial and pathological fractures, attending our institution over a period of one year. All the patients were subjected to radiography (OPG and CT with 3D reconstruction) for classification of fracture based on location and number, and surgical management was planned based on the same. All patients underwent ORIF with MMF either by extraoral or intraoral approach. MMF was performed either with arch bar or eyelet wiring. Post-operatively, outcome assessment was done on the basis of union of mandible, occlusion, pain, infection, facial deformity, neuro-sensory disturbances and trismus.

**Result:** Males in the age bracket of 21-30 years was most commonly affected. 76.7% of the cases were caused by road traffic accidents and parasymphysis (19 cases) was the most common site followed by the body (13 cases). Post-operative outcome parameters like occlusion were assessed by Angle's classification, pain by visual analogue scale (VAS), and mouth opening by measuring inter-incisor distance. At the end of 6 months, the rate of overall complications was 3.3%.

**Conclusion:** Mandibular fracture is most common among young males, with road traffic accidents being the commonest etiology. Parasymphysis fracture is the most common site of fracture. CT with 3D reconstruction is helpful in the evaluation of complex fractures. Most of the patients had a normal bone union. ORIF provides optimal stability with precise reduction, superior aesthetic results and early restoration of functional life.

## KEYWORD:

Mandibular fracture; parasymphysis; orthopantomogram (OPG); open reduction & internal fixation (ORIF); maxillo-mandibular fixation (MMF); inter-maxillary fixation (IMF); occlusion; trismus.

## INTRODUCTION:

In the initial part of the last century, where the industry was at bay and the transport was slow, fracture in any part of the skeleton was a rarity. Since the turn of the last century, with the advancement of civilization, there has been a rapid boom in industrialization leading to exponential growth in the automobile industry. Growth in the automobile industry was met with an equally proportional growth in road traffic accidents which is one of the leading causes of facial bone fractures including mandibular fractures.

The fracture is defined as a “breach in the continuity of bone”<sup>1</sup>. The facial area is one of the most frequently injured areas of the body, accounting for 23-97% of all fractures<sup>2</sup>. The mandible is a horseshoe-shaped, mobile facial bone, which is strategically located as well as structured, to bear, the brunt of all sorts of stress and strain. Hence, it commonly fractures, when the limits of stress and strain cross normality. Mandibular fractures occur twice as often as mid-facial fractures<sup>3</sup>. The energy required to fracture the mandible is 44.6-74.4 kg/m<sup>2</sup>, which is about the same as zygoma, half of that for frontal bone and four times that required for maxilla<sup>4</sup>. Areas that exhibit weakness include the area lateral to the mental protuberance, mental foramen, mandibular angle, and the condylar neck<sup>3</sup>.

Mandibular fractures occur most frequently in males during the third decade of life<sup>5</sup>. In the elderly, it is likely to be associated with falls<sup>6</sup>. All reports show a higher frequency in males aged 21-30 years<sup>7</sup>. In India, motor vehicle collisions are the leading cause of mandibular fractures<sup>8</sup>.

Fridrich et al. showed that most fractures occur in the body (29%), condyle (26%), and the angle of the mandible (25%). The symphysis accounts for 17% of mandibular fractures, whereas fractures of the ramus (4%) and coronoid process (1%) have lower occurrence rates. In automobile accidents, the condylar region, in motorcycle accidents, the symphysis, and in assault cases, the angle demonstrated the highest incidence of fracture. The study also reported that in patients with mandible fractures, 43% of the patients had an associated injury<sup>9</sup>. In patients with mandibular fractures, 53% of patients had unilateral fractures while 37% had 2 fractures and 9% had 3 or more fractures<sup>10</sup>.

The technique of rigid internal fixation was developed and popularized by Arbeitsgemeinschaft fur Osteosynthesefragen/ Association for the Study of Internal Fixation (AO/ ASIF) in Europe in the 1970s. The basic principles of the AO, outlined by Spiessl, call for primary bone healing under conditions of absolute stability<sup>11</sup>. This is accomplished by interfragmentary compression plates.

The four AO/ ASIF principles are: Anatomical reduction, functionally stable fixation, atraumatic surgical technique, and immediate active function.

During the same time that Spiessl was expounding the AO doctrine, Champy et al. in France were developing the concept of adaptive osteosynthesis. Champy advocated transoral placement of small, thin, and malleable stainless steel miniplates with monocortical screws along an ideal osteosynthesis line of the mandible. Champy believed that compression plates were unnecessary because of masticatory forces that produce a natural strain of compression along the inferior border<sup>12</sup>.

The above two methods revolutionized the treatment approach to mandibular fractures. Many fractures previously treated with closed reduction or open reduction with wire osteosynthesis are now commonly treated with open reduction with plate and screw fixation. An example of this evolution is the treatment of comminuted mandibular fractures which were thought to be treated best by closed reduction to minimize stripping of the periosteum of small bone fragments. Although this treatment modality is still used, rigid fixation now enables the clinician to avoid closed reduction with the use of reconstruction plates and good soft tissue coverage<sup>13</sup>. The indications for closed versus open reduction have changed dramatically over the last century. The ability to treat fractures with ORIF has dramatically revolutionized the approach to mandibular fractures<sup>14</sup>. Traditionally, closed reduction and ORIF with wire osteosynthesis used to require an average of 6 weeks of immobilization by MMF for satisfactory healing. Difficulties associated with this extended period of immobilization include airway problems, poor nutrition, weight loss, poor hygiene, phonation difficulties, insomnia, social inconvenience, patient discomfort, work loss, and difficulty recovering normal range of jaw function. In contrast, rigid and semi-rigid fixation of mandible fractures allow early mobilization and restoration of jaw function, airway control, improved nutritional status, improved speech, better oral hygiene, patient comfort, and an earlier return to the workplace<sup>15</sup>.

## MATERIALS AND METHODS:

This is a prospective observational study done on 30 patients who attended the department of ENT, Head & Neck Surgery at Nil Ratan Sircar Medical College & Hospital, Kolkata, over a period of one year.

This study was conducted after institutional ethical committee clearance was obtained and written consent taken from all the patients of mandibular fracture, recommended for open reduction and internal fixation after fulfilling the inclusion and exclusion criteria.

**A. Inclusion criteria:** Fractures due to road traffic accident, fall, assault, sports without any neurological deficit or hemodynamic instability.

**B. Exclusion criteria:** Mandibular fracture as a part of pan-facial fracture or pathological fracture.

Selected patients were then subjected to detailed history taking and physical examination. Dental evaluation was performed in patients with significant carious or periodontal destruction. Then patients were subjected to radiography (more commonly OPG & CT scan with 3D reconstruction). All investigations were done for general anaesthetic fitness.

After CT scan with 3D reconstruction, mandibular fracture was classified according to the site and number of fracture and surgical management was planned accordingly. All the patients underwent ORIF after MMF. MMF was performed either by arch bar or by eyelet wiring

#### Surgical procedure:

1. All the patients underwent open reduction under general anesthesia by nasogastric intubation/ submental intubation.

2. Surgical evaluation of stability of teeth was performed under GA. Those teeth meeting the following criteria were extracted: (1) teeth with fractured roots (2) teeth that were unsalvageable as a result of caries or infection in the region of the fracture; and (3) teeth within the fracture line that were loose or unstable. Stable teeth within the fracture line were preserved for added reduction stability.

3. Arch bars or eyelet wires placed and MMF wires secured prior to incision.

4. Surgical approach was done through intraoral vestibular incision or extraoral incision or through the existing wound for access to the fracture line depending on the location of the fracture.

Intraoral approach- (Indication- fracture in symphysis, parasympysis or body) incision is made leaving at least 1 cm cuff of tissue from the mucogingival junction for closure. Dissection is carried to bone. Freer's elevator is used to dissect below the periosteum up to the inferior border of the mandible. Mental nerves identified and preserved.



Figure 1: Pre-operative OPG showing parasympysis fracture of mandible



Figure 2: Post-operative OPG showing parasympysis fracture of mandible



Figure 3: CT with 3D reconstruction showing parasympysis & angle fracture of mandible

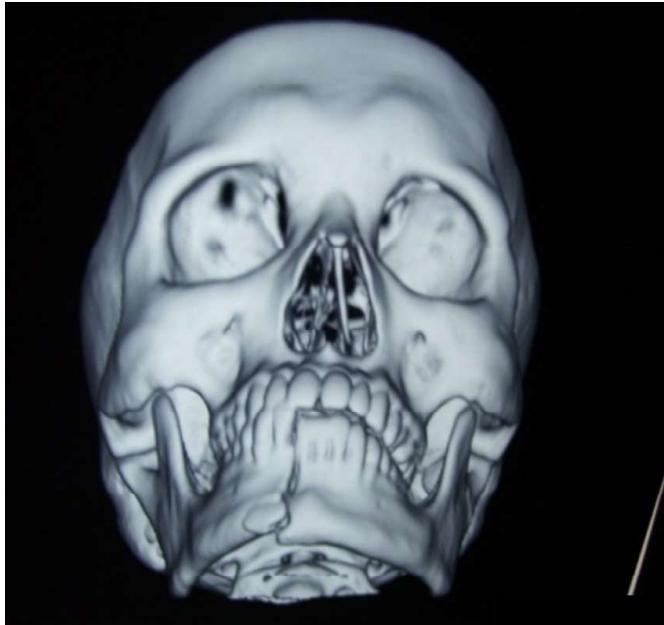


Figure 4: CT with 3D reconstruction showing symphysis fracture of mandible



Figure 5: Homan's retractor



Figure 6: Arch bar and SS wire

**External approach-** (Indication- fracture in angle and ramus) 5 cm incision is made 2 to 2.5 cm below the angle of the mandible on a skin crease and extended postero-superiorly toward the earlobe. Platysma is incised 2 cm inferior to the skin incision. Dissection is carried down to the posterior belly of the digastric. Once the digastric is identified, dissection is carried superiorly up to the inferior border of the mandible. The periosteum is incised. Freer's elevator is used to elevate the periosteum to expose the fracture.

5. Intervening soft tissue is removed from the fracture line.

6. Fracture reduced, occlusion checked and MMF wires tightened.

7. The normal four hole miniplate with screws of 6-8 mm length was preferred in most cases. Alternatively, four-hole plates with bar, six hole plates with or without bar was used especially where there is involvement of mental foramen, danger of injury to root tips, or there are comminuted fracture.

8. Intraoral incisions closed with chromic catgut or vicryl suture. For external approach, drain is placed platysma is closed with a running locking vicryl suture, deep dermal interrupted monocryl sutures are placed, and the skin is closed with nylon/ prolene running suture.

#### Postoperative care:

Wire cutter is kept at bedside upon leaving the operating room for removing MMF wires if patient vomits to prevent aspiration. Post operative antibiotics continued for 10 days. Oral hygiene is stressed, including daily brushing of the teeth and arch bars. Dental wax was used to protect the buccal mucosa from the sharp edges of the wires and arch bars, where applicable. MMF and arch bars were removed after 1 and 6 weeks respectively. Patients' post-operative diet was restricted to liquids in the first week followed by a soft diet for 1 month.

#### Follow up:

Patients were followed up clinically after 1 week, 2 weeks, 4 weeks, 8 weeks, 3 months, and 6 months to assess the outcome of the ORIF

Outcome assessment was done according to the following parameters:

#### 1. Union of mandible-

Nonunion was assessed by mobility at fracture site. Malunion was assessed by malocclusion.



Figure 7: Mandible tray containing multiple sizes of screws, plates & drill bits



Figure 8: Securing of arch bars



Figure 9: Maxillomandibular fixation

2. Occlusion- Occlusion is the way in which one's maxillary and mandibular teeth relate to each other when the jaw is closed. When treating fractures of the mandible, the first and primary objective is to re-establish the patient's pre-injury occlusion. Angle's classification is most commonly used to define a patient's occlusion and has three classes.

In Class 1 occlusion the mesio-buccal cusp of the maxillary first molar rests within the mesio-buccal groove of the mandibular first molar.



Figure 10: Vestibular approach



Figure 11: External approach

In Class 2 occlusion (retrognathism) the maxillary first molar is more anterior in relation to the mandibular first molar.

In Class 3 occlusion (prognathism) the maxillary first molar is more posterior in relation to the mandibular first molar. Two other malocclusions are open bite and cross bite.

3. Pain- Duration and intensity of postoperative pain is assessed with visual analogue scale (VAS). No pain- 0, mild pain- 1 to 3, moderate pain- 4 to 6, severe pain- 7 to 10.

4. Infection- Assessed by pain, swelling, redness, raised temperature and if any discharging sinus at the site of fracture.

5. Facial deformity- Facial appearance to include profile considerations, restoration of symmetry and post-operative scarring.

6. Neurosensory disturbances- The most commonly injured nerve associated with mandibular fractures is the inferior alveolar nerve and its branches especially, the mental nerve.

The prominent sign of inferior alveolar nerve deficit is numbness or other sensory changes in the lower lip and chin. A rare but impressive nerve deficit is that the marginal mandibular branch of the facial nerve.

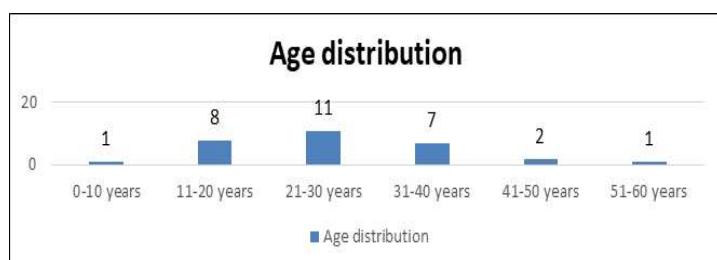
7. Mouth opening (trismus) - maximal mouth opening checked by inter-incisor distance.

Trismus is assessed according to the average inter-incisor vertical mouth opening (between the upper and lower central incisors). Normal: 40 to 50 mm, Functional: 25 to 35 mm and Limited: 10 to 24 mm.

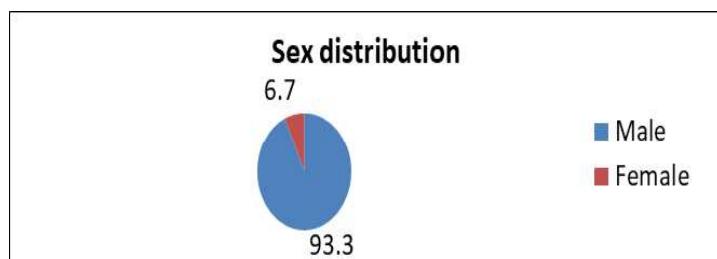
Radiological assessment, preferably with OPG was done postoperatively to assess healing process.

## RESULT AND ANALYSIS:

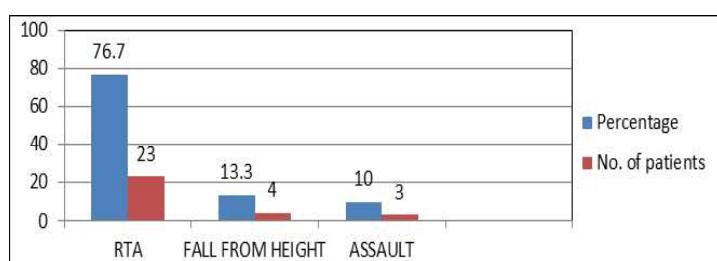
Age distribution:



Sex distribution:

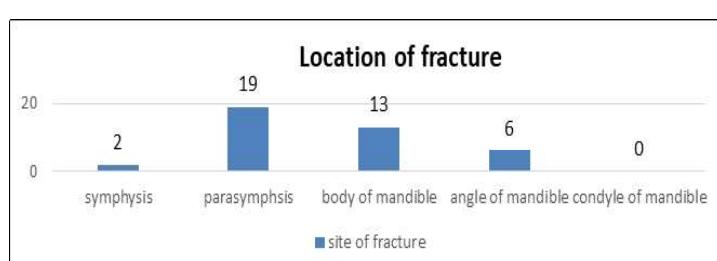


Etiology of mandibular fractures:



Distribution of location of fractures of mandible:

Out of 30 patients the total number of fractures was 40.



Surgical approaches:

Table 1: Surgical approaches

Surgical approaches	Number of patients	Percentage
Intra oral	18	60%
Extra oral	10	33.33%
Both intra oral and extra oral	1	3.33%
Through existing scar	1	3.33%
Total	30	100%

Overall outcome measures:

Table 2: Overall outcome measures at the end of six months

Outcome	Pre-operative	Post-operative (6 months)
Union of mandible	0%	96%
Occlusion	13.4%	100%
Pain	100%	0%
Infection	0%	0%
Facial deformity	100%	0%
Neurosensory disturbances	0%	0%
Trismus	86.6%	0%



Figure 12: Post-operative malocclusion



Figure 13: Post-operative ORIF showing discharging sinus with infected skin

## DISCUSSION:

Historical references regarding mandible fracture diagnosis and treatment date back to 1650 BC as evidenced by the Edwin Smith Surgical Papyrus<sup>16</sup>. Hippocrates was the first to describe reapproximation and immobilization through the use of circumdental wires and external bandaging. Most fracture treatment, however, involved some form of external bandage or wrap, occasionally used in conjunction with a bridle wire, until the 19th century, when Gilmer reformed the treatment of fractures by fixed full arch bars on the mandible and the maxilla<sup>17</sup>. In 1888, Schede was the first to use a solid steel plate held by 4 screws for fixation<sup>18</sup>.

The two management principles of AO rigid internal fixation and the Champy method of monocortical miniplates revolutionized the treatment approach to mandibular fractures. The treatment of mandibular fractures has changed significantly in the past century. The uses of a Barton bandage or a Gunning splint has evolved to the use of MMF alone, MMF plus open reduction with intrabony stainless steel wire fixation and MMF with open reduction using bone plates and screws.

In this study, the incidence of mandibular fracture was highest in 21 to 30 years of age (36.7%) which was in conformity with Adi et al.<sup>19</sup>, Bataineh<sup>20</sup>, Dongas and Hall<sup>21</sup>, Ahmed et al.<sup>22</sup>, Brasileiro and Passeri<sup>23</sup>, but contradictory to Shapiro et al.<sup>24</sup> who reported 34.1 years as mean age range.

Males predominate with 93.3% of the cases, while females constitute a minor percentage of 6.7%, that is, in a ratio of 14: 1. This conforms with Adi et al.<sup>19</sup>, Bataineh<sup>20</sup>, Dongas and Hall<sup>21</sup>, Ahmed et al.<sup>22</sup>, Brasileiro and Passeri<sup>23</sup> and Shapiro et al.<sup>24</sup>.

The most common etiologic factor in this study is road traffic accident (76.6%) which is in accordance with Bataineh<sup>20</sup>, Ahmed et al.<sup>22</sup>, Brasileiro and Passeri<sup>23</sup> and Shah et al.<sup>25</sup>. Adi et al.<sup>19</sup> and Dongas and Hall<sup>21</sup> reported assault as the main cause. Road traffic accident is still the major cause probably due to reckless and high-speed driving, reluctance to use helmets and seat belts and inadequate enforcement of traffic safety rules.

In this study, out of 30 subjects, 22 (73.3%) were reported as unilateral while bilateral accounted for 8 cases (26.7%). In an epidemiological study, Natu et al. reported 56.1% of patients had a unilateral mandibular fracture while 43.9% patients had bilateral fractures<sup>8</sup>.

In the present study, 73.3% patients had one fracture, 20% patients had two fractures and 7.7% patients had more than two fractures. Hai-Won Jung et al. reported single fracture line in 47.5% patients, two fracture lines in 51.35 % patients and 1.2% patients had three fracture lines 26 .

The parasympysis being the commonest site of fracture in this study, is contrary to Adi et al.<sup>19</sup>, Bataineh<sup>20</sup>, and Shah et al.<sup>25</sup> who reported body as the commonest. While Dongas and Hall<sup>21</sup> reported angle as the commonest, in a different study Ahmed et al.<sup>22</sup>, and Brasileiro and Passeri<sup>23</sup> stated condyle as the most common site of fracture. The parasympysis is probably the commonest site due to the presence of permanent tooth buds in the pediatric mandible presenting a high tooth to bone ratio, while in adults it is partly due to the length of canine root weakening the structure.

Both OPG and CT scan with 3D reconstruction were done in our study as an essential part of management workup. The panoramic radiograph can provide a good initial evaluation of mandibular trauma allowing visibility of the entire mandible, including the condyles, dento-alveolar complex and dentition. In this study, CT scan was done to assess the angulations and/or displacement of the fractures better. Multislice computed tomography (MSCT) is progressively replacing the panoramic radiograph for mandibular trauma, and is increasingly being performed to detail and classify mandibular trauma<sup>27</sup>. CT is being increasingly applied to define the fracture location and the degree of dislocation in mandibular trauma. The great advantage of CT in comparison with panoramic radiography is the ability to image soft tissue<sup>28</sup>.

Traditional teaching has been that mandible fractures should be reduced within 24 hours of injury. In our study the time taken between injury and open reduction was 7 days because our institution is a tertiary referral centre where patients are referred from other hospitals

In the meantime, callus formation occurred and we had to freshen the fracture line to remove the callus. Recent studies have shown no increase in complications with a delay beyond 24 hours<sup>29</sup>.

In our study, we used miniplates for internal fixation. Miniplates are less palpable externally and less thermally sensitive to the patient. A higher incidence of complications has been noted in fractures treated with compression plates<sup>30</sup>. Use of micro miniplates for mandibular surgery is limited because of their inability to provide rigid fixation and tendency for plate fracture during the healing process<sup>31</sup>. Laughlin et al. showed in their study that resorbable plates are equivalent to titanium 2 mm plates with regards to fracture healing<sup>32</sup>. A study showed that there is no major difference in terms of treatment outcome between conventional and 3D miniplates<sup>33</sup>.

In a prospective randomized clinical trial comparing the 2 mm locking plates versus 2 mm standard plates, Agarwal et al reported that there was a significant decrease in postoperative pain measured in visual analogue scale (VAS) scores<sup>34</sup>.

Malunion may occur as a result of plate bending or poor intra-operative reduction of fractured segments. The malunion encountered in this study was minor in nature and required no surgical intervention. In a prospective study, Umar Khitab et al. reported malunion in their study was minor in nature<sup>35</sup>.

In our study, preoperative trismus was present in most of the (26 patients out of 30) patients and 3 months after surgery, all patients achieved normal mouth opening. In a study Mohammad Waheed El-Anwar et al. reported normal mouth opening 8 weeks after surgery<sup>36</sup>.

In our study infection was the commonest complication (10%). The pattern of fracture, technical errors, lack of prophylactic antibiotics, mobility at the fracture site and the non compliance of patients are considered the predisposing factors for infection<sup>37</sup>. Two patients responded to antibiotics and one patient required plate removal. The second most common complication noted was post-surgical malocclusion (6.2%). Malocclusion was based on evaluation of occlusion, checked for maximum interdigitation, midline relationship, molar relationship and patient complaints. Previous reports of Dodson TB et al.<sup>38</sup> (7.7%) also coincides with the present study.

In this study sensory disturbances were recorded in one patient as the disturbances of inferior alveolar nerve. In postoperative OPG, there was no inferior dental canal penetration by screw. It may be due to the elevation of flap and stretching of the nerve. The sensory disturbances disappeared after 3 months follow up of the patient. In our study, there was no record of any involvement of the mandibular branch of the facial nerve as has been reported by Dodson TB et al.<sup>38</sup>

Jaques B et al.<sup>39</sup> reported 1.45% sensory disturbances in the mental nerve while Gabrielli MA et al.<sup>40</sup> reported 0.89% paresthesia in the inferior alveolar nerve after applying rigid fixation.

## CONCLUSION:

This prospective observational study was performed on 30 patients of mandibular fractures who attended the OPD and Emergency in the department of ENT, Head & Neck surgery at Nil Ratan Sircar Medical College & Hospital, Kolkata within a time frame of 1 year. Panfacial and pathological fractures were excluded from this study. All the cases were treated by ORIF with MMF for 1 week. In this study, most of the patients were male between ages 20 to 30 year. The commonest cause of mandibular fracture was road traffic accident. The commonest sites of fracture were as follows- parasympysis, body, angle and symphysis respectively. The following outcomes were measured and evaluated for 6 months- pain (VAS score), trismus, occlusion, union of fracture, facial deformity and neurosensory disturbances. At the end of 6 months, the rate of overall complications was 3.3%, with pain score coming down zero with no trismus and neurosensory disturbances and facial deformity.

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# A COMPARATIVE STUDY ON VOICE RANGE PROFILE (VRP) AND SPEECH RANGE PROFILE (SRP) IN ADULTS WITH AND WITHOUT VOCAL NODULES

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## Abstract:

Vocal sound is based on the complex yet co-ordinated interaction of phonatory system, resonatory system and respiratory system. The present study had the objective to determine the voice range profile and speech range profile in normophonic and dysphonic adult speakers with vocal nodule.

15 Male and 15 Female subjects' age range between 20-40 years were considered in both normophonic and dysphonic groups. These subjects were screened for voice separately through VHI, GRBAS, Dr Speech analysis(Version 4) and vocal folds visual inspection done by strobovediaryngoscopy (KayPentax, 9400).

Both groups were asked to phonate /a/ to register VRP and SRP from low to high pitch. Speaking Voice (SV) was determined by reading 20 sentences in Bengali language at a habitual pitch. The ShV (Shouting voice) was obtained by asking patients to say /ehi/ twice as loud as they could. The various parameters such as fundamental frequency, maximum and minimum frequency, SPL range, maximum and minimum intensity and area for VRP and SRP were recorded by using phonetogram software Dr speech (Version 4).

The statistical analysis was done and central tendency(mean) was used for measuring the mean of age range. t-test was conducted to evaluate significant difference of VRP and SRP between normophonic and dysphonic subjects for all eight parameters.

As a result, a significant difference was found in VRP and SRP between normophonic and dysphonic groups. From the result, In VRP, the p-value of frequency parameters (Male and Female) was <0.0001, p-value of intensity parameters (Male and Female) were 0.137 (SPL Range), 0.0001 (I max), 0.0002 (I min), p-value of area parameters (Male and Female) was 0.1206, and p-value of semitones parameters (Male and Female) was 0.0015. From the result, in SRP, the frequency parameters of SRP, p-value was <.0001.

In conclusion SRP procedure was easier and faster to administer than VRP. Normophonic group shown reliable changes in frequency and intensity while doing VRP, they were able to maintain the lowest and highest frequency with respect to loudness. VRP and SRP values were predominantly higher in normophonic than dysphonic group in both male and female, except fundamental frequency.

**Keywords:-** Phonetogram, Voice Range Profile, Speech Range Profile, Vocal Nodule.

## INTRODUCTION

The voice is unique and complex in the entire human being and it is the root of human verbal communication. It plays a key role in humans to express their emotions.

Basically, the process behind the generating voice can be classified into three parts; the lungs, the vocal folds and the articulators (Zemlin,2011)<sup>1</sup>.

The voice is an integral part of that uniquely human attribute known as speech. The larynx and its capabilities are important in two broad areas: biological function and speech. (Bateman, 1984)<sup>2</sup>.

Hence, the voice is a powerful tool that not only delivers the message but also adds to its meaning. By the age 18yrs or so, the voice reaches its mature or adult stage.

The fundamental frequency is where it will remain for several decades. The individual has full control over the dynamic range(loudness) of the voice and can produce many variations of pitch and voice quality. These vocal abilities reflect the maturation of the anatomical and physiological systems for the support of speech (Kahane,1982)<sup>3</sup>.

Phonetography is accessible and readily available tool in research field which helps in measuring the potentiality of voice output (Klingholz and Martin, 1983)<sup>4</sup>.

The speech range profile, or what is sometimes referred to as an habitual or speech Voice Range Profile (VRP), distinguishes itself from the physiological Voice Range Profile (VRP) recording in that it specifically aims at recording continuous speech.

This type of phonotographic recording was introduced quite early, with the appearance of the computerised phonograph. Ma et al. (2006)<sup>5</sup> concluded that speech range profile (SRP) would be an acceptable alternative to traditional Voice Range Profile (VRP) for screening the presence of dysphonic in a busy clinic where quick screening results are desirable.

It is clear from the above studies that Speech Range Profile(SRP) has a potential for clinical application. Chatterjee, Halder, Bari, Kumar, and Roychoudhary (2011)<sup>6</sup> administered a study which was aimed to analyze the change in acoustic parameters based upon age and gender effects and to obtain normal voice range profile (VRP) of adult male and female of three different age range.

## METHODOLOGY

Descriptive survey with Expost-facto research design was used. For this study, samples were taken from normal population and voice problem cases.

A total number of 60 participants, aged between 20 to 40 years were taken for the study. The subjects were divided into two groups. Among them, 30 were normal and other 30 were dysphonic.

Group I: This group included 30 normophonic subjects (mean age= 25.6, SD ± 5.6) in which 15 subjects (mean age=26.8, SD ± 3.2) were male and 15 subjects (mean age =24.9, SD± 5.8) were female. The Normophonic subjects were having a Voice Handicapped Index (VHI) score of ≤ 20 with no vocal pathology found in Strobovideolaryngoscopy(Kay PENTAX, Laryngeal strobe, model 9400) and normal voice parameters were found in Dr. Speech analysis.

The inclusion criterias followed for Group I were, the normophonic subjects were untrained singer and non-professional voice users, no regular medication which will affect voice, did not have any chronic medical problem for the last 6 months, having no any respiratory tract infection, no hormonal,

psychogenic and neurological voice disorder, no any recent history of common cold and throat infection, no having history of smoking or regular consumption of alcohol, proficient in speaking and reading Bengali language, did not have under gone any laryngeal and neck surgery.

The exclusion criterias for Group I, were the normophonic subjects were having normal hearing sensitivity as defined by pure tone threshold at frequency from 0.25 to 8 KHz ( $\leq 20$  dB HL) and were excluded from the influence of menstrual cycle.

Group II: This group included 30(mean age= 27.9, SD±8.7) dysphonic subjects in which 15 subjects (mean age= 27, SD±2.8) were male and 15 subjects (mean age 26.5±4.1) were female.

The inclusion criterias for Group II were the Dysphonic subjects were having bilateral vocal nodule which diagnosed by using Strobovideolaryngoscopy(Kay PENTAX, Laryngeal strobe, model 9400) with Voice Handicapped Index score of > 20 and predominantly hoarseness were found in Dr. Speech analysis and GRABAS (Hirano et al 1981)who have not taken speech therapy, not taking speech/voice therapy, should be untrained singer and non-professional voice users, not on regular medication which will affect voice, did not have any chronic medical problem for the last 6 months, no any respiratory tract infection, having normal hearing sensitivity as defined by pure tone threshold at frequency from 0.25 to 8 KHz ( $\leq 20$  dB HL), did not have under gone any laryngeal and neck surgery, no any recent history of common cold and throat infection, no history of smoking or regular consumption of alcohol, proficient in speaking and reading Bengali language, were able to follow the proper changes in the voice from lowest pitch to highest pitch for Voice Range Profile (VRP).

The Exclusion criterias for Group II were the Dysphonic subjects were not having hormonal, psychogenic and neurological voice disorders and were excluded from the influence of menstrual cycle. Instruments were used Dr. Speech Phonetogram version 4 (Tiger DRS, Inc., 1998), MAX CM- 903 Electret Condenser microphone , RadioShack USA Model No: - 33-2055) sound level meter. Phonetographic recommendations by the Union of European Phoniatricians (UEP) (Schutte and Seidner, 1983)<sup>14</sup> were followed.

The microphone with omidirectional characteristics was placed at the angle of 45 degree at the distance of the 30 cm from the speaker's mouth. The commonly present surrounding noise should not exceed 40 dB (A).

Measurements were done in a room with moderately damped vibrations. Phonetograms were registered at speech science laboratory of Ali Yavar Jung National Institute for the Hearing Handicapped, Eastern Regional Centre, Kolkata.

The microphone collects the voice sample and sends it via the sound card in a digitized form whereupon the software, using a default algorithm, extracts the metrics from the sample and creates the phonogram which is displayed on the screen.

An automated procedure was used to measure the Voice Range Profile(VRP) of the subjects. Subjects were instructed to phonate a sustained vowel/a/ as soft and as loud as possible from the lowest to the highest frequencies.

Before recording, subjects were asked to practice pitch gliding for at least three times for vocal warming-up to facilitate the production of maximum vocal performance. The low Voice Range profile(VRP) intensity contour was measured first followed by measurement of their upper intensity contour. Low loudness was obtained without whispering, while the maximum loudness was reached without causing any kind of discomfort in the throat.

In order to motivate patients to perform to their maximum capacity, the investigator provided verbal support and auditory examples if needed so.

The Voice Range profile (VRP) was measured twice for each intensity contour. The required time to obtain the Voice Range profile (VRP) was approximately 20 min.

The following parameters were analyzed: Lowest Frequency (Fmin, Hz), Highest Frequency (Fmax, Hz), number of Semitones (ST) and Minimum Intensity (Imin, dB SPL), Fundamental Frequency (F0), Maximum Intensity (Imax,dB SPL).

In order to obtain the SRP, the Speaking Voice (SV) and Shouting Voice (ShV) were recorded. The SV was carried out by asking subjects to read aloud twice 20 sentences at their most comfortable pitch and loudness as in daily conversation. Subjects were allowed to practice reading the sentences aloud before actual recording.

The sentences chosen were characterized by different prosodic features (i.e.: interrogative, affirmative, exclamatory) and they expressed different feelings (i.e.: happiness, angry, sadness, disbelief, disappointment). The ShV (Shouting voice) was obtained by asking patients to say /ehi/ twice as loud as they could. The examiner provided suggestions such as "Imagine being in a street where there is a lot of traffic noise, you have to call someone who is away from you, on the other side of the street" in case the subject could not understand exactly how to say /ehi/.

Three initial trials were done before the recording for facilitation of the subjects. Overall, the recording time to obtain the SRP was approximately 10 minutes for individual subject. To test the repeatability of the SRP, it was recorded three times in 30 randomly selected subjects (30 subjects of control group and 30 subjects of dysphonic group).

Each test was performed after one hour from the other. The parameters analyzed in the SRP were: Lowest Frequency (Fmin, Hz), Highest Frequency (Fmax, Hz), number of Semitones (ST) and Minimum Intensity (Imin, dB SPL), Fundamental Frequency (F0), Maximum Intensity (Imax, dB SPL).

The collected was saved into the Microsoft excel (2007) for statistical analysis & for preparing tables and graphs. In Statistical analysis, Central tendency (mean) was used for measuring the mean of age range. Standard deviation was calculated for measuring the standard deviation (S.D). t-test (p-values) was conducted to evaluate significant difference of VRP and SRP between normophonic and dysphonic subjects for all eight parameters. (SAS software 9.2 version). This analysis was done for getting results on values of VRP and SRP for normophonic and dysphonic males and females individually.

## RESULTS AND DISCUSSION

The aim of present study were to compare result across two group of subjects i.e. normophonic and dysphonic adult speakers with respects by using Voice Range Profile (VRP) and Speech Range Profile (SRP) and compare the results between male and female groups in between normophonic male and female, dysphonic male and female by using voice range profile (VRP) and Speech Range Profile (SRP).

For many years, VRP was a used in a classification of singing voice and diagnosis of dysodia (Siupsinskiene, 2003)<sup>7</sup>. Nevertheless, due to the ease of handling and it provides visual results, over time VRP has become widely used to check the frequency range of phonation even in non-professional voice users. . As widely accepted in the literature, the critical points of a phonogram are the highest and lowest frequencies and the softest intensity (Wuyts et al., 1998, Heyning 2000, Molenberghs 2000)<sup>8</sup>. However, even if these three points may reflect the individual's a physiological vocal limit or capacity, several authors(- Ma et al., 2006, Coleman 1993, Gramming and Akerland 1991)<sup>9</sup> have discussed their reliability and validity.

Indeed, the VRP is subject to different procedural factors that can lead to high intra- and inter-subject variability (Gramming and Akerland 1988)<sup>10</sup>. Basing on our long-standing clinical experience, we noted that non-professional voice users often show trouble in performing VRP, with both the traditional and the fully automated procedures.

Traditional VRP is recorded using sustained phonation. Other factors such as the patient's embarrassment and lack of ability to match the pitch also made it difficult to

perform VRP recordings in both dysphonic and healthy speakers. The literature reports that to obtain a satisfactory VRP around 20-30 min are necessary.

In our experience, the time spent for the VRP is consistent with these data.

In contrast, overall the procedure that we utilized for SRP required an average time of 10 min for each subject. Our SRP included the reading aloud and shouting voice tasks that are easy to perform because they reflect habitual speech behaviours.

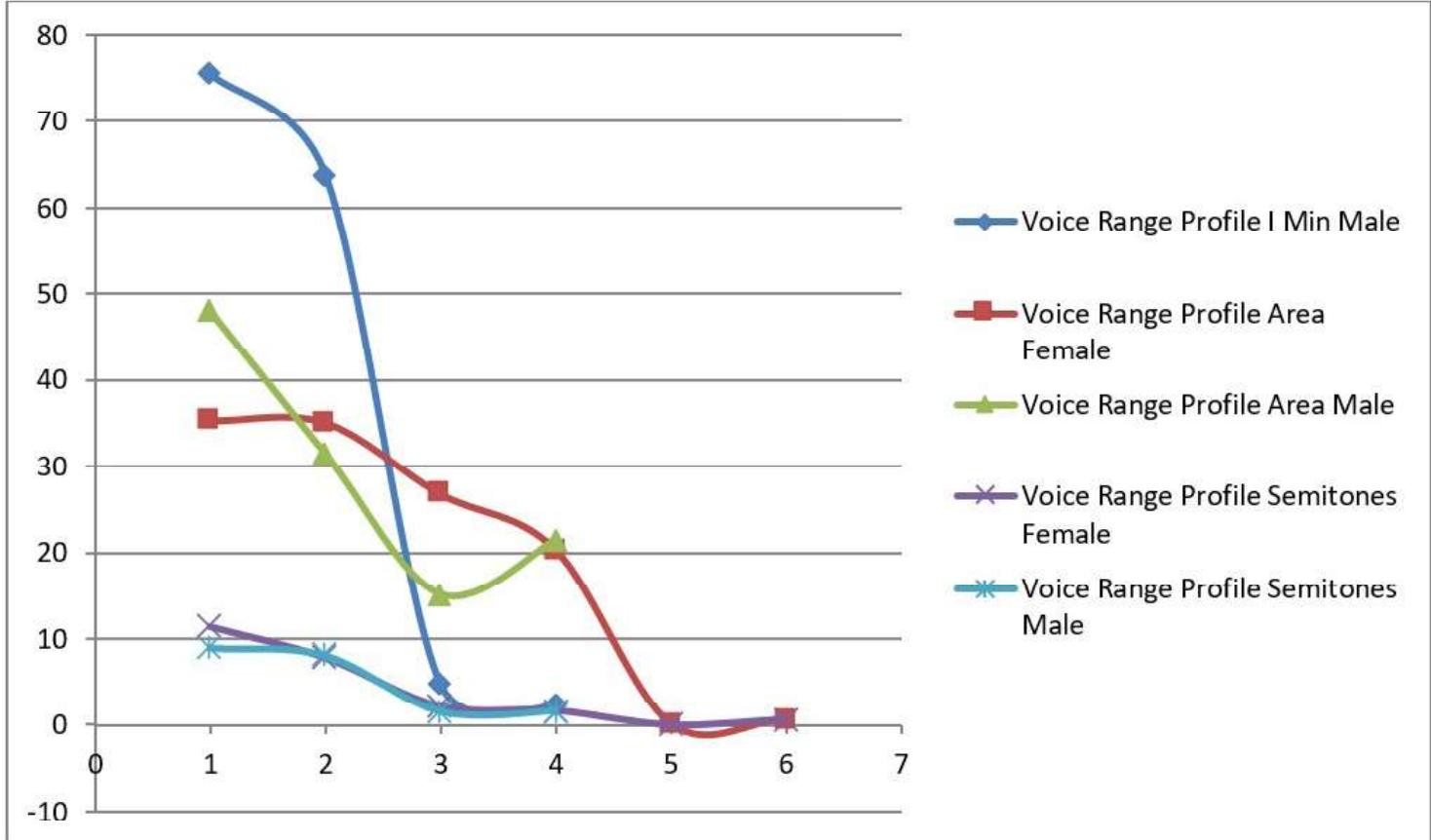
Table: Normophonic vs Dysphonic Data on VRP and SRP among males and females

Range of Profile	Parameters	Group	Mean (Hz)		SD		P value	
			Female	Male	Female	Male	Female	Male
Voice Range Profile	F0 Range	Normophonic	160.8	108.77	12.876	11.321	0.2161	.8667
		Dysphonic	170.73	107.93	23.899	15.304		
	F0 Max	Normophonic	379.6	283.67	36.565	27.93	<.0001	<.0001
		Dysphonic	266.57	180.76	43.721	15.697		
Speech Range Profile	F0 Range	Normophonic	35.111	31.547	20.338	21.551		
		Dysphonic						
	F0 Max	Normophonic	167.1	110.92	34.628	10.178	0.2043	.9151
		Dysphonic	152.97	110.35	23.734	17.753		
	F0 Min	Normophonic	361.46	236.42	36.989	12.598	<.0001	<.0001
		Dysphonic	298.15	197.69	31.989	7.914		
	SPL Range	Normophonic	233.17	160.94	20.715	11.068	<.0001	<.0001
		Dysphonic	183.68	98.193	24.904	6.6652		
	I. Max	Normophonic	17.6	19.1	3.3846	3.3138	<.0001	<.0001
		Dysphonic	10.393	11	1.42	2.3679		
	I. Min	Normophonic	81.167	89.433	6.8359	4.3456	<.0001	<.0001
		Dysphonic	67.873	73.18	1.9714	1.7346		
	I. Min	Normophonic	66.593	78.073	6.6034	4.0271	0.0167	.0008

		Dysphonic	35.111	31.547	20.338	21.551		
Speech Range Profile	F0 Range	Normophonic	167.1	110.92	34.628	10.178	0.2043	.9151
		Dysphonic	152.97	110.35	23.734	17.753		
	F0 Max	Normophonic	361.46	236.42	36.989	12.598	<.0001	<.0001
		Dysphonic	298.15	197.69	31.989	7.914		
	F0 Min	Normophonic	233.17	160.94	20.715	11.068	<.0001	<.0001
		Dysphonic	183.68	98.193	24.904	6.6652		
	SPL Range	Normophonic	17.6	19.1	3.3846	3.3138	<.0001	<.0001
		Dysphonic	10.393	11	1.42	2.3679		
	I Max	Normophonic	81.167	89.433	6.8359	4.3456	<.0001	<.0001
		Dysphonic	67.873	73.18	1.9714	1.7346		
	I Min	Normophonic	66.593	78.073	6.6034	4.0271	0.0167	.0008

Semitones	Dysphonic	61.467	69.633	4.1505	7.6739			
		Normophonic	10.036	8.4267	3.0504	1.343	0.3523	.0383
	Dysphonic	9.1333	9.6267	2.087	1.6624			
Area	Normophonic	46.131	49.593	12.609	15.031	0.1995	0.0965	
		38.38	39.193	19.052	17.924			
	Dysphonic							

Chart I: Voice Range Profile in normophonic and dysphonic data in female versus male.



Above graphical representation showed lower fundamental frequency in male than female in normophonic data. And females had higher maximum and minimum fundamental frequency than males.

Mean value of fundamental frequency in female and male was 161.8 Hz and 108.77 Hz and the mean value of the maximum fundamental frequency for female and male was 379.6 Hz and 283.67 Hz. As well as the mean value of minimum fundamental frequency for female and male was 235.2 Hz and 185.73 Hz. Males had higher mean value than female in all three parameters i.e. SPL range, maximum intensity level and minimum intensity level. The mean value of the SPL range in females and males was 11.92dB SPL and 14.92dB SPL. The maximum intensity level in female and male was 74.993 and 85.753 and minimum intensity level in females and males was 63.167 dB SPL and 75.533 dB SPL.

Mean value of minimum fundamental frequency in females was 221.2667 (standard deviation  $\pm$  13.28) and 122.00 (standard deviation  $\pm$  13.398) in males. Mean value of semitones in females was 11.469 and in males it was 9. Males were having higher area enclosed by phonotogram than females. Mean value of area in females and males were 35.355 and 48.093. These findings were supported by Chatterjee, Halder, Bari, Kumar, and Roychoudhry (2011) where they found the mean value of fundamental frequency range in female was 164.9333 Hz (standard deviation  $\pm$  16.04) and male was 50.80 Hz (standard deviation  $\pm$  16.15), mean value of maximum fundamental frequency was 385.533 (standard deviation  $\pm$  12.78)

in females and 170.80 (standard deviation  $\pm$  23.87) in males, they found mean value of maximum intensity in female and male was 105.7487 dB (standard deviation 14.496) and 107.2133 dB ( $\pm$  13.134) and minimum intensity level was 96.8933 dB ( $\pm$  15.11) and 100.6867 dB ( $\pm$  14.32), but in this study intensity range was higher in females than males.

Semitones were higher in normophonic females than males, mean value of semitones in female was 9.6667 dB\* semitones (standard deviation 1.04654) and in males 7.4667 dB\* semitones (standard deviation 2.06559), mean value of male and female subjects were 12.9000 (standard deviation 7.3) and 11.9667 (standard deviation 6.3531). In case of dysphonic data, as shown in above graphical representations, mean values of frequency parameters (fundamental frequency, maximum frequency, minimum frequency) were higher in female subjects than male subjects but in intensity parameters (intensity range, maximum intensity, minimum intensity) mean values were higher in male subjects than female subjects. As showed in above graphical representation. Mean values of semitones were higher in male subjects (8.1333) than female subjects (7.8667) but mean value of area was higher in female subjects (35.113 dB\* semitones) than male subjects (31.547 dB\* semitones).

There is no evidence of study done on comparison of frequency and intensity parameters, semitones and area parameters of Voice Range Profile (SRP) between dysphonic male and female subjects in the literature and journals.

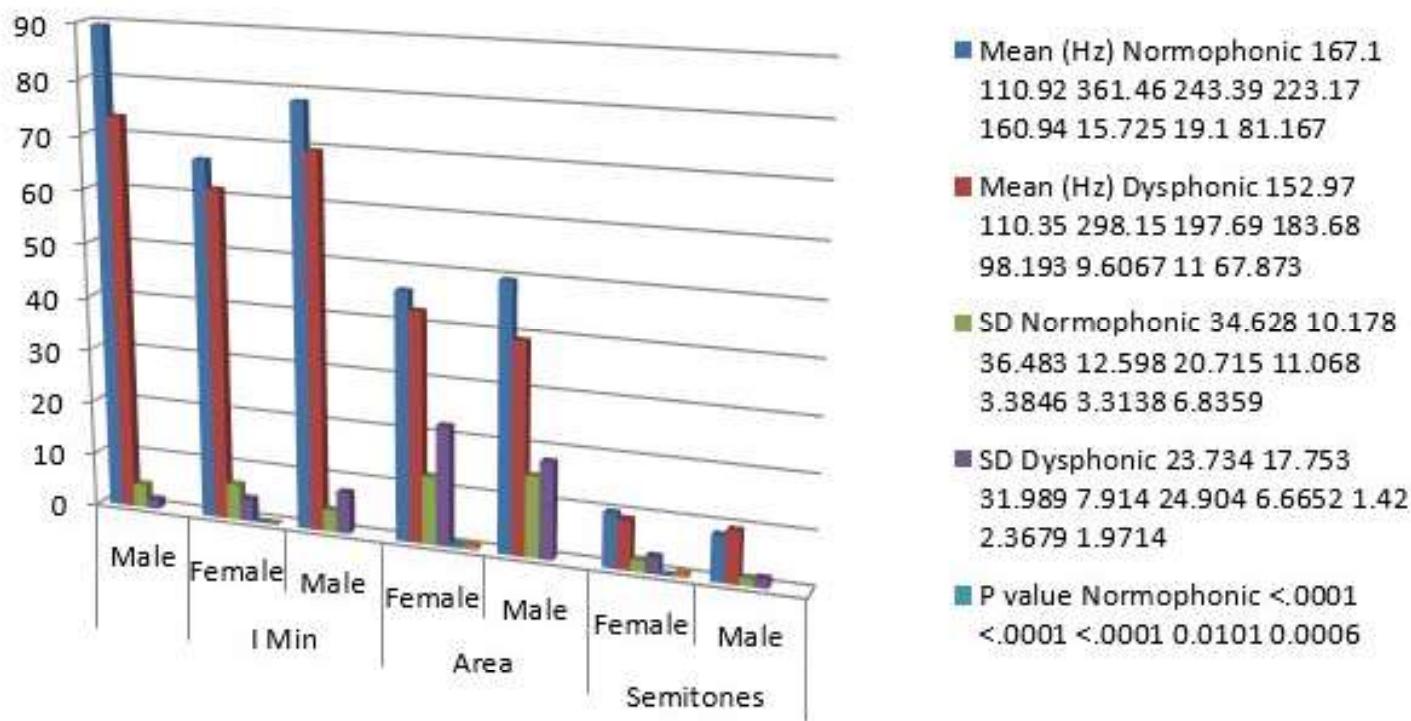
Frequency parameters, mean values of all three parameters (fundamental frequency, maximum frequency and minimum frequency) were higher in female subjects than male subjects.

Intensity parameters showed higher values in male subjects than female subjects. Mean values of fundamental frequency in normophonic male and female subjects were 167.1 Hz and 110.92 Hz, mean values of maximum frequency in normophonic female and male subjects were 361.46 Hz and 243.39 Hz and mean values of minimum frequency in normophonic female and male subjects were 223.17 Hz and 160.94 Hz.

The mean values of SPL range in normophonic female and male subjects were 15.725dB SPL and 19.1dB SPL, the mean value of maximum intensity in normophonic female and male subjects were 81.167dB SPL and 89.433dB SPL and the mean values of minimum intensity in normophonic female and male subjects were 66.593dB SPL and 78.073 dB SPL.

The finding was supported with the study of Balasubramanian, Bhat, and K.T. (2014)<sup>11</sup> had done a study on Indian population.

Chart II: Speech Range Profile in normophonic and dysphonic datas in female versus male.



As showed in above graphical representation, mean value were higher in female dysphonic subjects than male dysphonic subjects for all three parameters of frequency that is fundamental frequency, minimum frequency and maximum frequency.

The mean value of fundamental frequency in female and male were 152.97 Hz and 110.35 Hz, the mean value of maximum frequency in female and male were 298.15 Hz and 197 Hz and the mean value of minimum frequency in female and male were 183.68 Hz and 98.193.

The results were showed difference in all parameters of fIn study, SRP measure was obtained from the normal male and female adults in the age range of 18 to 40 years.

frequency and intensity in between male and female subjects. The mean value of maximum frequency in male and female subjects were 124 Hz and 205 Hz, the mean value of minimum frequency in male and female subjects were 107 Hz and 178 Hz, the mean value of maximum intensity in male and female subjects were 93dB and 90dB, the mean value of minimum intensity in male and female subjects were 83dB and 82dB and the mean value of intensity range in male and female subjects were 10 dB and 8 dB. The mean value of semitone was higher in female subjects than male but mean value of area was higher in male subjects than female subjects. The mean values of semitone in normophonic female and male subjects were 10.036 and 8.4267, and mean values of area in normophonic female and male subjects were 46.131dB\* semitones and 49.493dB\* semitones.

There is no evidence of study done on comparison of semitones and area parameters of Speech Range Profile

As showed in intensity parameters (i.e. intensity range, maximum intensity and minimum intensity) mean values were higher in male subjects than female subjects. The mean value of intensity range in female and male were 9.6067dB SPL and 11 dB SPL, the mean value of maximum intensity in female and male were 67.873dB SPL and 73.347dB SPL and the mean value of minimum intensity in female and male were 61.467dB SPL and 69.633dB SPL. Mean value of semitones were slightly higher in male (i.e. 9.1333) subjects than female subjects (i.e. 9.6267).

But mean value of area was higher for females subjects (i.e. 42.736dB\* semitones) than male subjects (i.e. 39.193dB\* semitones). There is no evidence of study done on comparison of frequency and intensity parameters , semitones and area parameters of Speech Range Profile (SRP) between dysphonic male and female subjects in the literature and journals.

## CONCLUSION

In conclusion SRP procedure was easier and faster to administer than VRP. Normophonic group shown reliable changes in frequency and intensity while doing VRP, they were able to maintain the lowest and highest frequency with respect to loudness. And while reading the 20 Bengali sentences for SRP normophonic subjects were able to changes there pitch and loudness according to the type of sentences. As well as in dysphonic group subjects were shown no difference in fundamental frequency but they were unable to reach higher frequency and intensity level as normophonic group in both VRP and SRP.

The present study attempted to obtain a normative data for the VRP and SRP in the age range of 20 to 40 years for males and females with and without vocal folds pathology (i.e. bilateral vocal nodules). The normative data obtained offers a valuable tool for the speech and language pathologists in the assessment and management of patients with voice disorders. This could also be used to track the changes following the vocal treatment and also to assess the efficacy of the given treatment procedure.

The findings of the study can be strengthened by expanding the research on a larger population and in different communicative environments. Further research is needed to evaluate the role of VRP and SRP in other specific vocal pathology like (vocal folds paralysis, spasmodic dysphonia, vocal polyps, vocal cyst etc) in untrained or trained singers with age group like children, adolescence and older individuals.

Moreover, it will be necessary to assess the sensitivity of SRP and VRP in detecting changes following medical, surgical and behavioural vocal treatment.

This study will help to discuss the role of SRP and VRP as a diagnostic tool, emphasizing its advantages in routine voice assessment.

## LIMITATIONS OF THE STUDY

A) The derivation of features from phonograms without distorting its shape.

B) The particular attention paid to the dynamic possibilities of the F0-SPL range used in normal speech. To demonstrate this method of automated evaluation, a

normal phonogram as well as a pathologic (dysphonia) phonogram was processed, and the resulting parameter values were compared with normative data. In future this study will present the data of normophonic and dysphonic (with vocal nodules) subjects.

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# ECTOMESENCHYMAL CHONDROMYXOID TUMOUR OF TONGUE-REPORT OF A RARE CASE

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## ABSTRACT:

Ectomesenchymal Chondromyxoid Tumour of Tongue is a relatively recently described entity. We report the case of ECMT on the dorsal aspect of tip of tongue occurring in a 30 year old male. It is a slowly growing benign neoplasm occurring predominantly in anterior aspect of tongue. Histologically it is characterized by lobular proliferation of oval to spindle shaped cells against a chondromyxoid background. Cytodiagnosis of the lesion is often difficult as there is lack of awareness about this entity and it can be misdiagnosed as other myxoid or chondroid neoplasms. Excision is curative for this entity and no recurrence was observed in this case after a 10 month follow-up.

**Keywords:** Ectomesenchymal Chondromyxoid Tumour of Tongue , Benign tumours of tongue

## INTRODUCTION:

Ectomesenchymal Chondromyxoid Tumour of Tongue is a relatively uncommon entity<sup>1</sup>. Limited number of cases have been reported in English literature. We report the forty-ninth case of ECMT affecting the tip of anterior surface of tongue and the problem of cytodiagnosis of the lesion.

## CASE REPORT:

A 30-year old man presented at the ENT OPD at NRS Medical College, Kolkata with the history of gradual development of a smooth round swelling over dorsal aspect of tip of tongue over past six months (Fig 1).



Figure 1

The swelling was firm, measuring 2.5 cm in diameter and overlying mucosa was unaffected. FNAC of the swelling produced low cell yield. The cells were of medium size, round to oval in shape, with central bland appearing nuclei and moderate amount of cytoplasm. Scanty stromal fragment was seen in the background. The impression on cytology was of a benign mesenchymal neoplasm.

No categorization was possible. The nodule was excised and submitted for histological examination. Grossly the mass was a well-circumscribed nodule, 1.8 X 1.5 cm in size, firm on feel with focally cartilaginous cut surface. On histopathology, it showed lobular pattern (Fig 2) comprising of oval to spindle shaped cells of medium size lying in a chondromyxoid background (Fig 3). Cells did not show any features of anaplasia and there was no necrosis or mitotic activity. The lesion was diagnosed as Ectomesenchymal Chondromyxoid Tumour of Tongue. Immunohistochemistry showed diffuse and strong positivity for GFAP (Fig 4) and weak positivity for keratin. EMA was negative.

The patient has been followed up for 10 months and there has been no recurrence.

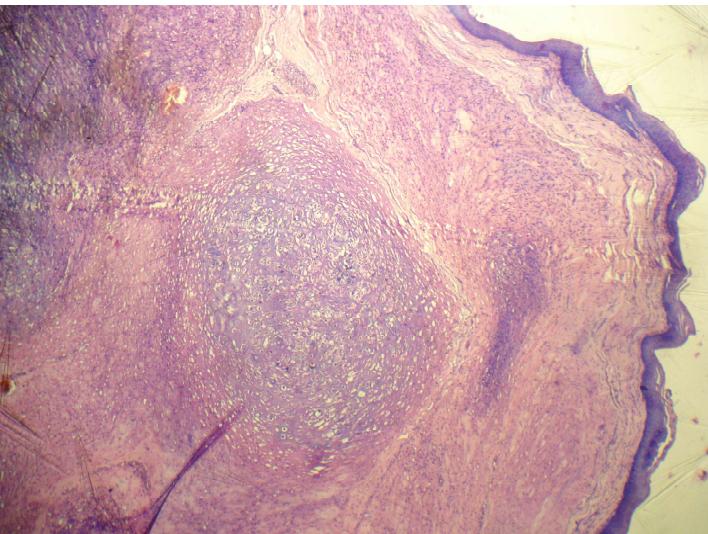


Figure 2

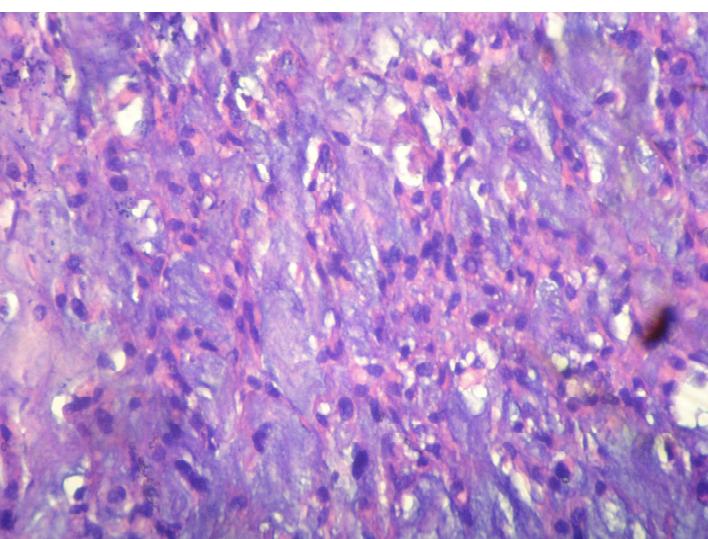


Figure 3



Figure 4

## DISCUSSION:

Ectomesenchymal Chondromyxoid Tumour Of Tongue is a seldom reported entity. It predominantly affects the tongue, on the anterior or dorsal surface, though Nigam, et al, described the same tumour in hard palate<sup>2</sup>.

FNAC of the lesion yields abundant myxoid fibrillary material obscuring the relatively innocuous appearing round to oval cells leading to misdiagnosis as pleomorphic salivary adenoma or other myxoid/ chondroid lesions, e.g., soft-tissue myxoma, nerve sheath myxoma and myxomatous changes in various soft tissue neoplasms. Lack of familiarity with the lesion is also responsible for inaccurate cytodiagnosis<sup>3</sup> and it may cause misdiagnosis on histology also<sup>4</sup>.

Presence of a low cellular yield composed of few round to oval cells with scanty myxoid stromal material in the background led to the diagnosis of benign mesenchymal neoplasm in this case.

In this case, absence of abundant myxochondroid stromal substance prevented from a cytodiagnosis of PSA. The histopathology of this lesion is characteristic and shows well-circumscribed lobular proliferation of ovoid and round cells growing in net-like sheets in a chondromyxoid background<sup>5</sup>.

IHC in this patient showed strong and diffuse positivity for GFAP. Keratin showed weak positivity. EMA was negative. These findings are in corroboration with that of other authors<sup>5</sup>.

This is a slowly growing benign neoplasm. The patient was treated with excision in this case and there was no recurrence during follow-up. The cases reported in literature were all treated with excision and the lesion proved to be a non-recurrent one. The histogenesis of this lesion is yet to be defined clearly. It is unlikely to derive from myoepithelial cells<sup>6</sup> and possibly derives from undifferentiated ectomesenchymal progenitor cells migrating from the neural crest<sup>7</sup>.

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# JUVENILE XANTHOGRANULOMA OF THE EAR: A RARE CASE REPORT

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## ABSTRACT:

Juvenile xanthogranuloma is a rare entity. It primarily, is a disease of infancy. It has been documented in its rarest form in an adult.

This is a case report of an adult-onset juvenile xanthogranuloma of both ears , proved by histopathology and IHC.

Key Words: Ear; Ear tumours; Juvenile xanthogranuloma; Skin lesions

## INTRODUCTION

Juvenile xanthogranuloma (JXG) is a rare disorder, which belongs to the broad group of non - Langerhans cell histiocytosis<sup>1</sup>. Also it is the most common form of non-Langerhans cell histiocytosis<sup>2</sup>. Mostly, JXG is a benign cutaneous fibrohistiocytic lesion that usually presents during infancy or early childhood.

Classically, it presents as solitary or multiple yellowish papules or nodules. The most common sites of involvement are the head, neck and trunk<sup>3</sup>.

From studies in recent years, however, it is clear that there are many clinical forms of JXG beyond this classic description. In such cases, the diagnosis may be more difficult to make without knowledge of the different possible clinical variants.

We describe a case of JXG with a rather unusual clinical presentation, and highlight the importance of considering this entity in the differential diagnosis of benign soft tissue tumours of the ear.

## CASE PRESENTATION

A 22 year old boy was referred to the department of ENT & Head-Neck Surgery, Calcutta National Medical College & Hospital, with a diffuse fungating enlargement of both the ears (Figures 1 and 2), which was first noticed 2 months earlier as an area of redness.

The lesion initially started with a small reddish papule at the pinna, which later showed progressive growth along with appearance of some other similar lesions around it. It then took a form of fungating ear swelling with multiple diffuse brown-to-yellowish papulonodular eruptions. These eventually became quite prominent with occasional bleeding from the lesions. The boy was otherwise healthy.

The physical examination, revealed multiple yellow-brown, relatively well-demarcated papulonodular lesions with variable sizes (2–8 mm in diameter).



Figure 1



Figure 2

Figure 1 & 2 : Diffused fungating enlargement with multiple diffuse brown-to-yellowish papulonodular eruptions of right and left ear respectively.

Lesions were shiny, soft to elastic in consistency consistency present almost all over the pinna of both right & left ear [Figure 1 & 2].

The surface of some lesions were scaly. There was no vesication, erosion, or crusting. The mucous membranes, palms and soles, chest were unaffected and ophthalmologic examination was normal.

No other systemic involvement was noted. No other family members were affected.

The following differential diagnosis was made: lepromatous leprosy, tuberous xanthoma and xanthogranuloma. Laboratory investigations, including routine hematological examination, liver and renal function test, were within normal range. Serum levels of lipids were not raised. The Ziehl-Neelsen stain for acid fast bacilli was negative.

Histopathological examination revealed dense granulomatous dermal infiltrates consisting of foam cells, multinucleated giant cells (mainly Touton type), histiocytes, lymphocytes, and a few eosinophils and neutrophils. The epidermis was thinned out without any grenz zone and inflammatory cells extended toward lower dermis to subcutaneous tissue (Figure 3 & 4).

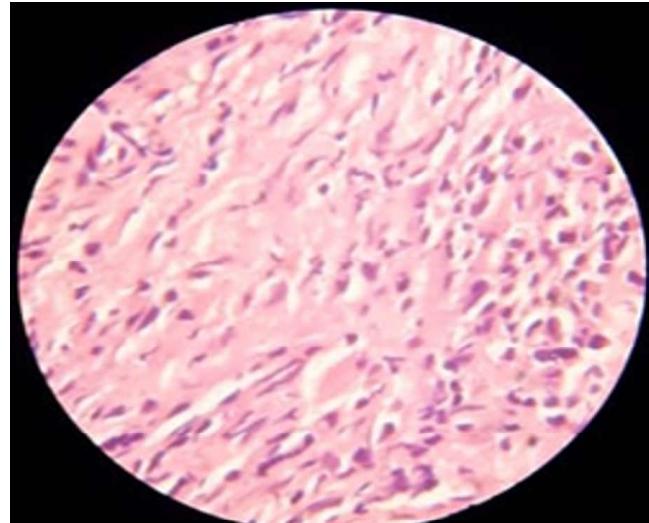


Figure 3

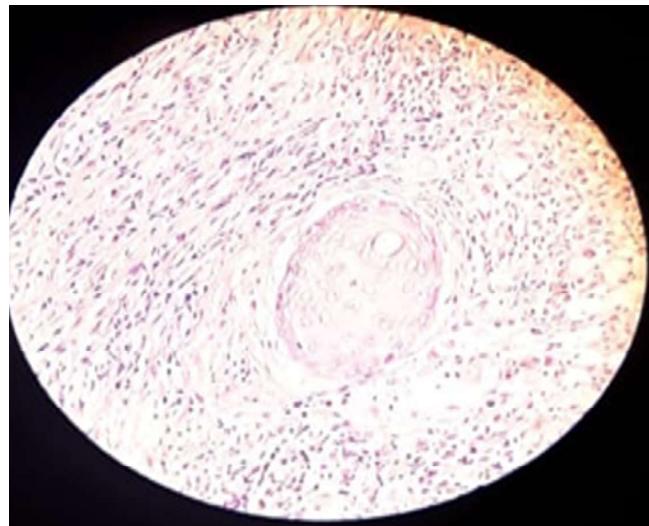


Figure 4

Figure 3 & 4. Microscopy shows foamy histiocytes and mononuclear cells Fig. 4. Shows a Touton giant cell.

The Cytology of the lesion confirmed that the histiocytes are non-Langerhans cells and led to the diagnosis of juvenile xanthogranuloma.. X-ray of chest and skull were normal. Ultrasonography of abdomen and pelvis showed no visceral involvement.

As there was a diffuse involvement with disfigurement, we planned to give some treatment to halt the disease process rapidly. We started isotretinoin 20 mg once daily after food. Patient was reviewed after one month and noted about 50% reduction of size of lesion . Same treatment was followed for another one month and noticed that most of the lesions had flattened with yellowish and hyperpigmented macules with decrease of size of lesion .

Repeat lipid profile and liver function test was done and no abnormalities were detected.

## DISCUSSION:

Histiocytic disorders are broadly divided into two categories : Langerhans cell histiocytosis and non-'Langerhans cell histiocytosis.

Juvenile xanthogranuloma is classified under non-LCH and is also the most common of the non-LCH. It is a self-limiting and relatively uncommon benign cutaneous fibrohistiocytic lesion which can also affect deeper tissues and organs.

JXG is believed to result from a disordered macrophage response to a nonspecific tissue injury, resulting in a granulomatous reaction<sup>3</sup>.

JXG has been documented in many visceral locations such as lung, bone, testis, gastrointestinal tract, heart, eye and oral cavity<sup>4</sup>.

It can manifest as a multisystem disease <sup>5</sup>. Lesions can be single or multiple, well demarcated, rubbery , yellow to red papulonodules ranging upto 2 cm.

It is a disease of infancy and childhood which is rarely documented in adult. An association with neurofibromatosis type 1 (NF-1) and juvenile chronic myelogenous leukemia (JCML) has been reported<sup>2</sup>.

Diagnosis is a combined approach of clinical and histopathological conclusion with IHC playing the vital role. Immunohistochemistry shows the lesions to be positive for factor XIIIa, CD68, CD163, fascin, and CD14 but negative for S100 and CD1. This can be used to differentiate these lesions from Langerhans cell histiocytoses<sup>3</sup>.

Most individuals with juvenile xanthogranuloma (JXG) are asymptomatic. Mostly it is the aesthetic and cosmetic reasons needing treatment. But can lead to ulcer formation and bleeding as in our case. As there was a diffuse involvement with disfigurement, we planed to give some treatment to halt the disease process rapidly.

We started isotretinoin 20 mg once daily after food. Patient was reviewed after one month and noted about 50% reduction of size of lesion . Same treatment was followed for another one month and noticed that most of the lesions had flattened with yellowish and hyperpigmented macules with decrease of size of lesion . Repeat lipid profile and liver function test was done and no abnormalities were detected.

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# COVID-19 TRACHEOSTOMY, HOW WE DO IT: A SECONDARY CARE UK HOSPITAL EXPERIENCE

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## Abstract

In the UK, along with the whole world, we also experienced the deadly coronavirus outbreak. Based on our preliminary experience, we discuss the challenges in performing tracheostomy and tracheostoma care in the setting of a new pathogen.

**Key Words:** Tracheostomy, COVID 19, Pandemic, Personal Protection, Protocol

## Introduction

The advancement of the COVID-19 pandemic has led to an increasing need from surgeons of various specialties to perform tracheostomies on patients who have either tested positive for or are suspected of having the coronavirus infection. Therefore, steps must be taken to prepare these surgeons to perform the aforementioned tracheostomies, whilst taking precautionary measures to reduce the risk of infection to both themselves and other health-care staff as well as working in unfamiliar environments. The following paragraphs describe our experiences and the techniques we have utilised in, operating on COVID-19 patients. It must be noted that this advice is amenable to change and may even be completely disregarded as new information on COVID-19 surfaces. Therefore, the information given in the following paragraphs are only to be taken as overall guidelines rather than definitive rules.

Tracheostomy is a high-risk aerosol generating procedure next only to endotracheal intubation. However, with proper planning and PPE, it can be safely performed.

Due to the risk that emergency tracheal intubations impose on the operating personnel as well as on the rapidly deteriorating COVID-19 patients, early tracheal intubations are preferred (Sorbello et al., 2020).

Since long-term mechanical ventilation for critically ill patients represents the most common situation for which tracheostomy is indicated, the COVID-19 pandemic is likely to significantly increase the numbers of patients requiring new tracheostomies.

Due to the lack of specific clinical experience, currently there are few published reports on tracheostomies performed in patients with COVID-19 [(Givi et al., 2020), (Tay, Khoo & Loh, 2020) & (Vukkadala, Qian, Holsinger, Patel & Rosenthal, 2020)].

## Timing of Tracheostomy

Decisions regarding the requirement for tracheostomy and the timing to perform tracheostomy should be taken balancing the risks and burdens to both patients and staff.

There is no consistent guidance to help clinical staff plan the most appropriate time to perform a tracheostomy in the critically ill. In the month of April 2020, 36 tracheostomies were performed in our hospital, 19 open and 17 percutaneous. The initial 4 patients had their tracheostomy between 14 and 17 days post intubation while the rest between 7 and 10 days. The 54% survival rate of ventilated patients in our hospital is partially attributed to the early surgical airway placement.

Our experience is contrary to general recommendations of delaying or not performing tracheostomy in this cohort of patients (Michetti, Burlew, Bulger, Davis & Spain, 2020). Michetti et al., (2020) recommended delaying tracheostomy till after patient becomes COVID-19 negative or not performing tracheostomy at all. They recommended continuing standard ventilator weaning until extubation. Decisions regarding the requirement for tracheostomy and the timing to perform tracheostomy in critically ill COVID-19 patients should ideally be made in a multi-disciplinary setting balancing the risks and burdens to both patients and staff.

Bedside percutaneous tracheostomy (PT) is preferred as transport out of the ICU for open tracheostomy (OT) may be limited or restricted due to the risk of viral exposure to staff and to physiological instability of the patient. (Michetti et al., 2020). At this time, they also recommend against performing tracheostomy in patients with respiratory failure due to coronavirus. Similarly, Chao et al (2020) recommend not performing tracheostomy for at least 21 days after intubation as mortality in ventilated COVID-19 patients is extremely high.

The procedure followed is that recommended by the ENT UK (Harrison, Winter, Rocke & Heward, 2020).

#### Planning and pre-operative preparation:

The team comprises of an experienced surgeon, assistant surgeon, two anaesthetists – one at the head end and other near the anaesthetic machine at the foot end, scrub nurse, circulating nurse and an anaesthetic assistant. The suitability of patient for surgery especially the ability to lie flat and tolerate periods of apnoea are assessed. Surgery is performed in full paralysis to avoid any cough. Availability of PPE for all the team members is confirmed. All the instruments needed for tracheostomy and the various sizes of cuffed, non-fenestrated tubes, Heat Moisture Exchanger (HME) with viral filter are kept ready. As communication in full PPE can be difficult, during the briefing, all the team members are made aware of the exact steps that will be followed during surgery (Einav et al., 2010). The number of staff inside the operating room (OR) should be kept to a minimum as this will be considered dirty area once the patient is in. A 'clean' runner should be available outside for any communication or supplies.

The surgical trolley is laid out with the tracheostomy equipment and the tube. Syringe is attached to tracheostomy balloon for inflating it. Preload the HME onto the inner tube. Only closed in-line suction is used for endotracheal tube (ETT) and the tracheostomy tube (TT). Diathermy is avoided and surgical ties are kept ready. The patient is sent for only when the team and equipment are ready as above.

#### Operation Technique:

PPE is worn by all OR personnel with proper donning technique as recommended (NHS Scotland, 2020). The video shows correct order for donning, doffing and disposal of Personal Protective Equipment (PPE) for health-care workers (HCWs) in a primary healthcare settings (NHS Scotland, 2020). Another video clip shows how to safely don (put on) and doff (take off) the Personal Protective Equipment (PPE) for non-aerosol generating procedures (Public Health England, 2020).

The steps of surgery remain the same except for further precautions just before opening the trachea. A four-towel draping technique with easy access for head end anaesthetist to the ETT is used. Ligatures or bipolar diathermy is used for haemostasis. Once the trachea is exposed, the foot end anaesthetist is informed regarding readiness to open the trachea and paralysis of patient is confirmed. After preoxygenation with positive end expiratory pressure (PEEP) the ventilation is turned to manual and flows turned off.

We find it easier to control ventilation by switching to manual from this stage till insertion of TT. Time is allowed for passive expiration with open adjustable pressure limiting valve (APL). The head end anaesthetist will advance the ETT cuff beyond the proposed tracheal window, hyperinflate the cuff and commence ventilation till patient is well oxygenated. The ETT can be advanced with the high volume, low pressure cuff partially inflated and we have not noticed any trauma to the trachea.

It is essential that the cuff is intact till the tracheal incision/window is made and the surgeon is ready to insert the TT. The entry into trachea is made either through a vertical incision or an adequately sized window which prevents trauma to TT cuff while insertion. Following the steps as above, ventilation is ceased, the head end anaesthetist withdraws the ETT just proximal to the tracheal window as advised by the surgeon. The TT is inserted and cuff inflated immediately. The introducer is replaced with the non-fenestrated inner tube and HME. The circuit is attached promptly and ventilation resumed. The position of TT is confirmed with end tidal CO<sub>2</sub> which will avoid contamination of stethoscope. The patient is placed in the intensive care nursing position (30 degree head up) to check TT placement. Then the ETT is clamped and withdrawn. The TT is secured with sutures and tapes and dressing applied. Doffing of PPE with buddy check is done in the designated area. The equipment is disposed of according to local guidelines and operating theatre decontaminated after 20 minutes using local infection control protocol.

Following this meticulous technique, we did not have any infections of the personnel involved till date. Guidance for post procedural care should be followed.

## Conclusion

As Covid-19 infection is a novel disease, there is a lack of specific experience.

We have summarized our experience in performing tracheostomy and tracheostoma care in the setting of a new pathogen. Given the rapid evolution of the current Covid-19 pandemic this will be an early experience that is likely to change over time, so we encourage all our colleagues to share their experience.

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