INTRODUCTION

Temporomandibular disorders (TMD) refer to a collection of medical and dental conditions affecting the Temporomandibular joint and/or the muscles of mastication, as well as contiguous tissue components. The correct diagnosis of TMD is the most important factor in successful treatment. In the past during the diagnostic process of TMD problems, the imaging techniques were mainly focused on the head of the condyle, glenoid fossa, articular disc, ligaments and joint spaces but the muscles of mastication have always been neglected.

It is a known fact that the LPM has a close association with TMD. However because of difficulties in palpation of the muscle due to its anatomical location, difficulty in placement of electrodes accurately in the muscle for EMG studies\textsuperscript{1,2,3,4,5} and radiation hazards associated with CT scan this muscle still has not been studied to a great extent.

MRI is a non-invasive, non-ionizing, patient friendly imaging tool, which gives precise and accurate information about the soft tissues. Therefore this technique can be very useful in studying the lateral pterygoid muscle, thus overcoming the drawbacks and limitations of the various imaging tools\textsuperscript{6,7,8}. Thus MRI promises to be one of the important tools in evaluating the status of lateral pterygoid muscle in diagnosis of TMD.

Aims :- The aims of this study are:-

a. To evaluate MRI findings of the lateral pterygoid muscle in non-TMD subjects.

b. To evaluate pathological changes in the lateral pterygoid muscle by using MRI in patients suffering from TMD.

c. To compare MRI findings of the lateral pterygoid muscle with the clinical symptoms of TMD.

This study was designed to investigate MRI finding of LPM in non TMD subjects (control group) and to evaluate the pathological changes in LPM by using MRI in patients suffering from TMD.

Materials and Methods:- Total sample size was 46 individuals, amongst which 31 were patients who reported to Department of Orthodontics and Dentofacial Orthopedics, Bharati Vidyapeeth Dental College and Hospital, suffering from painful symptoms of TMJ of long duration. 15 volunteers, who did not suffer from any symptoms of TMD, were used as control group.
Following were the criteria for selection of patients:
1) Patients with history of pain and tenderness and/or Temporomandibular joint sounds only on one side for more than 6 months duration.
2) Age above 15 years and below 40 years.
3) No specific criteria for occlusion was considered.
4) No specific criteria for limitations in mouth opening was considered.

Following were the criteria for exclusion of patients:
1) Patients with tenderness of muscles other than LPM were excluded from the above sample.
2) Patients suffering from bilateral TMJ signs and symptoms.

Thus 11 patients were excluded from the study sample of 46. Total number of subjects became 35, including 15 volunteers from control group i.e. Total 70 joints were studied.

The study was performed with a 0.2-T magnet (Magnetom, Siemens), T1- weighted (528/12-20/1or2) (TR range/TE range/ excitations), T2- weighted (4100/123/1) and Proton Density (PD)(2000-3000/14-30/1), with 2-mm thick imaging slices, a 10X10 field of view (FOV) and a 256X123 or 172X250 dots per inch matrix were used for the images.

An open design “C” shaped magnet was used to increase patients comfort and operator ease.(Fig 1)

All the patients underwent bilateral MRI examinations of the TMJ with brain surface-coil. Oblique sagittal and coronal projections of lateral pterygoid muscle were used in mouth-closed position.

**Scanning Planes**

**Locator imaging**: The location of condyle and scanning planes was determined on cross-section locator imaging of TMJ.

**Coronal imaging**: The scanning planes were located in anatomical sagittal and coronal direction (Fig 2).

**Oblique sagittal**: The scanning planes were perpendicular or parallel to the long axis of the lateral pterygoid (Fig 3).

Slice thickness was 2mm and 12 slices were taken for coronal imaging and 6 slices were taken for sagittal imaging. 2 films per patients were printed.After completion of all scanning procedure for all the patients, the interpretation of the MRI finding of LPM was done with the help of a Radiologist. Following was the interpretation for normal and abnormal finding of LPM.

**Observations and Results**:

**TABLE I : DISTRIBUTION OF VOLUNTEERS WITH FATTY CHANGES**

<table>
<thead>
<tr>
<th>Fatty changes in muscles</th>
<th>PRESENT</th>
<th>ABSENT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.of patients</td>
<td>3</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>(20%)</td>
<td>(80%)</td>
<td>(100%)</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that 20% of the volunteers had fatty change while 80% volunteers had normal muscle structure.(p>0.05N.S.)

**TABLE II : DISTRIBUTION OF PATIENTS WITH FATTY CHANGES**

<table>
<thead>
<tr>
<th>Fatty changes in muscles</th>
<th>PRESENT</th>
<th>ABSENT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.of patients</td>
<td>17</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>(85%)</td>
<td>(15%)</td>
<td>(100%)</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that 85% of patients had fatty change in the muscle and 15% patients had no fatty change in the muscle.(p<0.01.S)

**TABLE III : TYPE OF PAIN AND ITS DISTRIBUTION**

<table>
<thead>
<tr>
<th>PERSISTENT</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>(30%)</td>
<td>(70%)</td>
<td>(70%)</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

The above table depicts 50% of patients had recurrent pain and 50% had persistent pain.

**TABLE IV:- DISTRIBUTION OF SEVERITY OF PAIN AND FATTY CHANGE**

<table>
<thead>
<tr>
<th>SEVERITY OF PAIN</th>
<th>V.A.S</th>
<th>1-3</th>
<th>4-6</th>
<th>7-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Presence of fatty change</td>
<td>4 (80%)</td>
<td>5 (71.4%)</td>
<td>8 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that 80% of patients having pain on VAS between 1-3 had fatty degeneration, 71.41% of patients having pain on VAS between 4-6 had fatty degeneration and 100% of patients having pain on VAS between 7-10 had presence of fatty degeneration in LPM.
The above table shows that 5 patients reported positive and 1 negative.

### TABLE VI: SIDE WISE DISTRIBUTION OF PATIENTS WITH FATTY CHANGES ON UNAFFECTED SIDE

<table>
<thead>
<tr>
<th>SIDE</th>
<th>LEFT</th>
<th>RIGHT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatty changes in muscles</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(30%)</td>
<td>(15%)</td>
<td>(45%)</td>
</tr>
</tbody>
</table>

The above tables shows that 45% had changes on opposite side, 30% had fatty changes on left side and 15% had changes on right side.

### TABLE VII: DISTRIBUTION OF PATIENTS WITH FATTY CHANGES AND LIMITED MOUTH OPENING

<table>
<thead>
<tr>
<th>PRESENT</th>
<th>ABSENT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatty changes in limited mouth opening</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(100%)</td>
<td>(100%)</td>
</tr>
</tbody>
</table>

The above table shows that all the patients with limited mouth opening (6 patients) had presence of fatty change in the LPM.(p<0.01)

### DISCUSSION :-

In order to diagnose pathological changes in the LPM, it was necessary to observe both bellies clearly on the images. Anatomical studies of the LPM have reported that the anterior part of the two bellies are separated by a space, or gap, which is filled by fibrous and adipose tissue and usually contains the maxillary artery, but the two bellies blend, or fuse, near the insertion (Sicher, Wilkinson). Imaging of the LPM in present study agreed with these anatomical findings. The two bellies could be well identified on the image with the anterior gap between the two bellies. This gap between was near the origin side of the LPM. When this gap was observed, it indicated that the most part of the LPM had been shown on the image and the image was suitable for diagnosis of morphological and signal intensity changes of LPM. However the two bellies could not be separately identified on all images due to low resolution of the MRI (Magnetom) machine used in this study which is 0.2 Tesla.

### PATHOLOGICAL CHANGES OF LPM

Diagnosis of atrophy of the LPM was based on signal changes of fatty replacement, which can be well identified in MRI (Schellhas\textsuperscript{10}, Benito et al). In the present study the LPM did not appear homogenous but diffuse hyperintense zones were visible in the muscle mass. The margins of the muscle were not well defined. Presently there is no method of classification to define the quantum of fatty degeneration in the muscle due to the diffuse nature of the pathology and the three dimensional structure of the LPM. According to the radiologists interpretation we have classified the fatty change into mild, moderate and severe. Hypertrophy was not compared as variations in size of the muscle between individuals might relate to many factors, including skeletal size, age, sex and general health (Schellhas\textsuperscript{10}, van Spronsen et al). Size and morphological comparing in the same individual with the asymptomatic side also has not been used in the diagnosis of hypertrophy in the LPM as even the opposite side had fatty degeneration in a few subjects. The result in this study found that the MRI abnormal findings of the LPM showed a close association with functional manipulation pain of the muscle. 85% (17) patients from the study sample of 20 showed fatty degeneration in the LPM whereas 15% (3) patients did not show fatty degeneration even though they had pain and click. (Table II)

It was also observed that the unaffected side LPM also showed evidence of fatty degeneration in some patients. 45% patients had pathological findings on opposite side even though the patient was asymptomatic on that side. On statistical analysis, p value > 0.05 confirms that the finding of fatty degeneration on unaffected side was not statistically significant. (Table VI)

Fatty degeneration can also be attributed to the muscle spasm which results in a decrease in blood supply to the affected part resulting in accumulation of the metabolic waste products and certain algogenic substances (eg bradykinin, prostaglandins) which cause muscle degeneration and muscle pain.\textsuperscript{11}

In this study, on correlating the presence of fatty degeneration in LPM and the type of pain (Table III), it was noticed that 40% patients had recurrent pain and 60% patients had persistent pain. No statistical significance was found between type of pain and presence of fatty degeneration (p value >0.05).

In the present study presence of limited mouth opening was seen in 30% of patients where as presence of fatty degeneration was seen in all (100%) the patients with limited mouth opening. On statistical evaluation statistically significant correlation (p value < 0.01) was found between limited mouth opening and presence of fatty degeneration. (Table VII)

### Pathological changes of the LPM in TMJ hypermobility

Clinically, different terms have been used to denote TMJ hypermobility, such as recurrent luxation of TMJ...
(Holmlund et al.), recurrent mandibular dislocation or recurrent subluxation of TMJ (Sacks et al.). The most common clinical complaint of symptomatic condyle hypermobility is clicking with painful symptoms related to TMJ and masticatory muscles (Katzberg et al., Holmlund et al.). Similar clinical symptoms of TMJs with condyle hypermobility were also found in present study.

The abnormalities of the LPM were also significantly more often found in the TMJs with symptomatic hypermobility. (Table V) Patients suffering from TMJ hypermobility patients had fatty degeneration. Presence of fatty degeneration in patients with TMJ hypermobility is statistically significant (p value < 0.01). These findings show that pathological changes of the LPM and condyle hypermobility may play important roles in giving rise to the symptoms in the TMD.

CONCLUSION

Following conclusions were derived from the study

- In control group, the LPM in 86.67% patients appeared normal with no pathological changes in the muscle. LPM appeared as a fan shaped muscle with dense homogeneous signal with well defined borders. Both, the superior and inferior of the LPM were visible on the oblique sagittal view.
- In 85% of patients suffering from lateral pterygoid myalgia, significant pathological change i.e. fatty degeneration was seen in the LPM. The LPM did not appear homogeneous but diffuse hyperintense zones were visible in the muscle mass.
- MRI abnormalities of the lateral pterygoid showed close associations with the main symptoms of TMD. i.e. All patients(100%) with pain and condylar hypermobility had significant presence of fatty degeneration in LPM.

Obviously, histological confirmation of the imaging pathological finding in the LPM is very important and further research is needed in the future.

REFERENCE:


Fig 1: Magnetom(Siemiens) 0.2 T MRI Machine
LOCALISER IMAGES

Fig 2.: Sagittal oblique section

Fig 3.: Coronal section

Fig 4.: Normal MRI of LPM a-LPM muscle, b-condyle, c- pterygoid plates

Fig 5.: Normal MRI of LPM d-superior belly, e- inferior belly.

Fig 6.: Fatty degeneration of LPM on oblique sagittal view f- fatty degeneration appearing as diffuse hyperintensities

Fig 7.: Fatty degeneration of LPM on coronal view f-fatty degeneration seen as hyperintense zones