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Title: Comparative Evaluation of Masseter Muscle Stiffness by Muscle Hardness Meter and Ultrasound Elastography in Patients with Temporomandibular Disorders -A Case-Control Study

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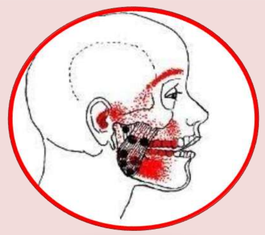
INTRODUCTION & AIM

Temporomandibular disorders (TMDs) are a group of musculoskeletal disorders of the stomatognathic system. Myofascial pain is common in TMD and manifests as trigger points. There are no objective methods to diagnose stiffness in myofascial pain. Elastography can detect muscle stiffness in TMDs.

Aim: Compare the stiffness of the masseter muscles using the Muscle Hardness Meter and Ultrasound elastography in patients with temporomandibular disorder and healthy adult volunteers

Muscle trigger points



METHOD

This case-control comparative study

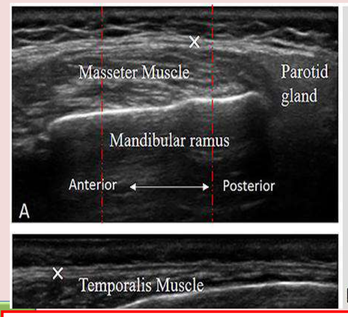
- Group A: 80 patients with TMDs (Patients with Myofascial pain (IA)
- Group B: 80 Adult healthy volunteers (Control group)
- DC/TMD criteria

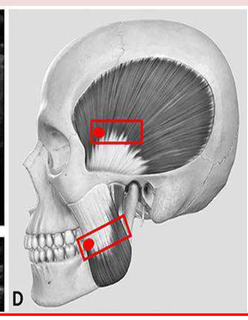
Parameters measured- Muscle hardness, Muscle thickness and Muscle elasticity index of the Masseter muscle

Neutones Muscle Hardness Meter

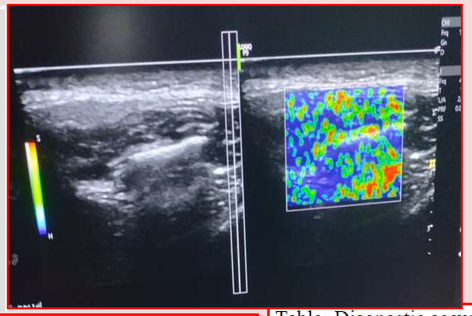
USG Elastography

Masseter muscle thickness

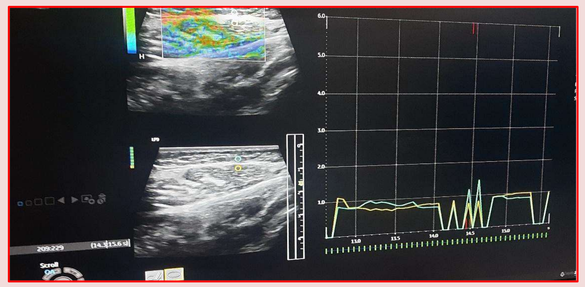




Colour-coded Elastogram



USG Elastography



RESULTS & DISCUSSION

Table 1 – Distribution of the study group by Independent t-test

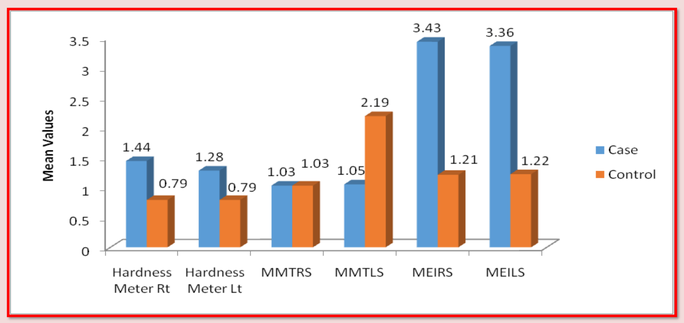
Variable	Group	N	Mean	SD	t-value	p-value	95% CI for mean difference	
							Lower	Upper
Age	Case	80	32.90	13.467	0.012	0.990	-4.059	4.109
	Control	80	32.88	12.679				

Parameter	Complaint Side Mean ± SD	Non-Complaint Side Mean ± SD	*t*-value	*p*-value	Significance
Muscle Hardness (N)	1.76 ± 0.220	0.79 ± 0.079	37.56	<0.001	Highly significant
Muscle Elasticity Index (MEI)	3.43 ± 1.748	1.21 ± 0.298	11.19	<0.001	Highly significant
Masseter Muscle Thickness (cm)	1.07 ± 0.208	1.03 ± 0.203	1.26	0.211	Not significant

Table- Diagnostic accuracy of Hardness meter and MEI by Receiver operative cure

Test Result Variable(s)	AUC	p-value	Cut-off
Hardness meter right side	0.894	<0.001	0.877
Hardness meter left side	0.856	<0.001	0.853
MEI right side	0.941	<0.001	1.45
MEI left side	0.916	<0.001	1.475

Foot note- AUC- Area under curve, MEI -Muscle elasticity index



Principal Component Analysis (PCA)

Cluster 0: High muscle stiffness, elevated pain, restricted mouth opening

Cluster 1: Moderate stiffness and function, often associated with parafunctional habits

Cluster 2: Low stiffness, minimal pain, near-normal function MEI, pain intensity, and mouth opening significantly differed across clusters ($p < 0.001$).

CONCLUSION

Strain wave elastography can serve as a diagnostic tool for evaluating the stiffness of the masseter muscle.

Muscle hardness meter- Chairside diagnostic tool

FUTURE WORK / REFERENCES

Multicenter studies with large sample sizes.

.1.Ophir J, Alam SK, Garra BS, Kallel F, Konofagou EE, Krouskop T, et al. Elastography: Imaging the elastic properties of soft tissues with ultrasound. J Med Ultrason (2001). 2002;29(4):155

2, Ariji, Y., Gotoh, A., Hiraiwa, Y. et al. Sonographic elastography for evaluation of masseter muscle hardness. Oral Radiol 2013; 29:64–69