The Correlation between Surface Electromyography and Bite Force of Mastication Muscles in Asian Young Adults

Sze-Ya Ting, Cheng-I Yen, Ming-Yih Lee, Chien-Tzung Chen, Chih-Hao Chen*

Department of Plastic and Reconstructive Surgery,
Chang Gung Memorial Hospital at Linkou, Taiwan
Nothing to Disclose

Background

- Surgical indication
  - Functional
    - EOM, diplopia, trismus,
    - malocclusion
  - Aesthetic
    - asymmetry

Outcome assessment

- Functional
  - Sensory
    - V1,V2,V3
    - Light touch, pain, 2-PD
  - Motor
    - Occlusion, MMO, diet

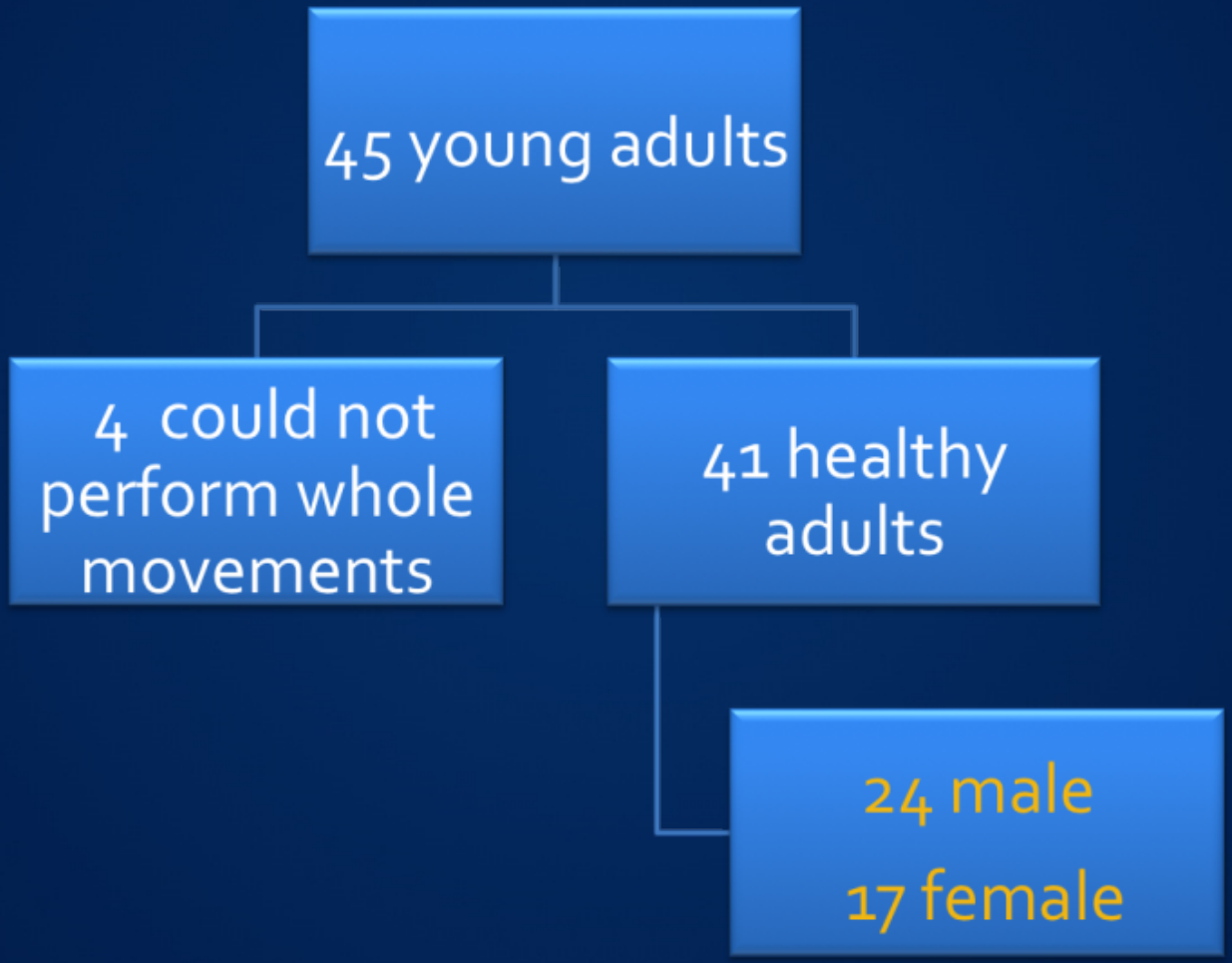
Previous studies

- Different recording system
  - No detail information about the device
- Small series (case<30)
- Not quantitative
- Gender limitation
- Not comprehensive evaluation

Purpose

- Clinically applicable, reliable, quantitative and noninvasive system
- Jaw movement and function
- Normal population

Materials and methods



Inclusion/exclusion criteria

- Inclusion criteria
  - young adult, 20~35 years old
  - fair dentition, normal occlusion
- Exclusion criteria
  - craniofacial anomalies
  - previous facial trauma/surgeries, orthodontic treatment
  - symptoms or signs of TMDs

Kinetic and sEMG

EMG

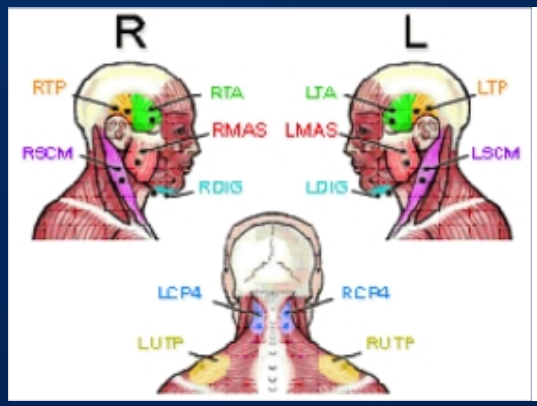
- The sEMG machine (Zebris, Germany)

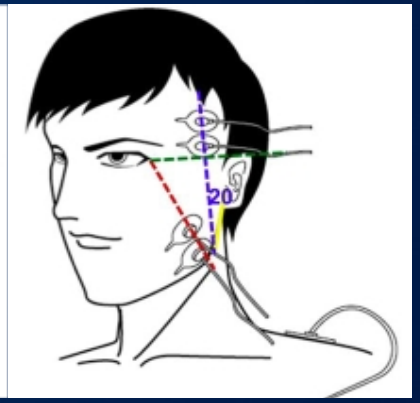
Alteration of Masticatory Electromyographic Activity and Stability of Orthognathic Surgery in Patients With Skeletal Class III Malocclusion

Ellen Wen-Ching Ko, DDS, MS, Chiung Shing Huang, DDS, PhD,† Lun-Jou Lo, MD,‡ and Yu-Ray Chen, MD§*

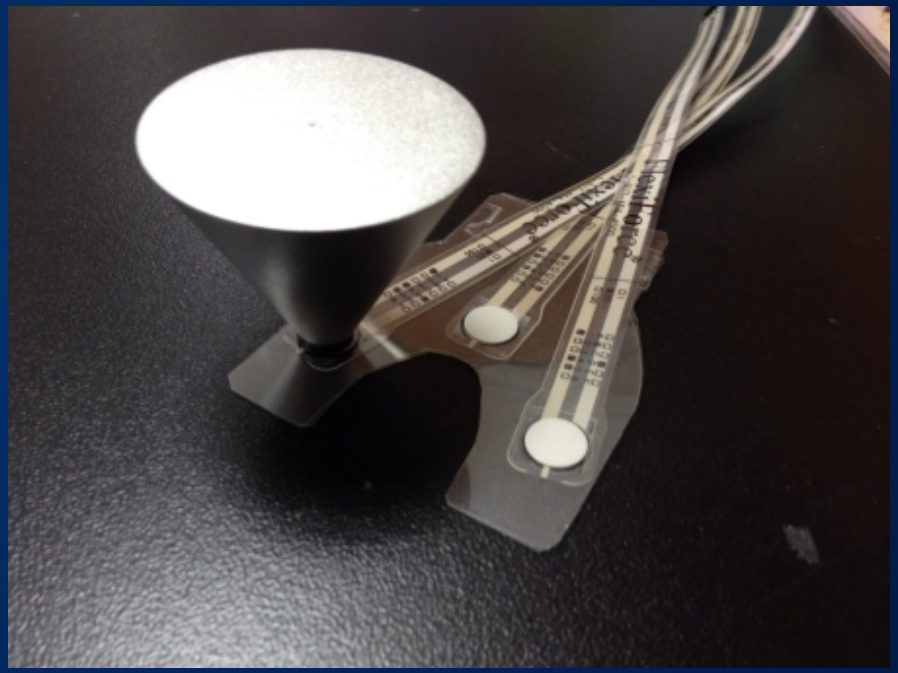
- Temporalis, masseter

J Oral Maxillofac Surg 71:1249-1260, 2013





Bite force



Modify protocol

- Bite as hard as possible for 2 seconds
- With bite force for 2 seconds
- Firing pattern
  - increasing force gradually for 10 seconds
- Fatigue test
  - Bite in full strength for 10 seconds

Statistical analysis

- SPSS package version 20.0
- Mann-Whitney U test
- Wilcoxon signed ranks test
- Statistically significant at $p<0.05$

RESULTS

巨承科技有限公司
G-CHEN Technology Corp.

Coretac Pressure System

Show: Bar Chart

Unit :

Sampling rate: 100 (Hz)

AutoScale Y.Scale: 50

Clear

Channel List

CH Name	Color	Value
Chan 1		0.1
Chan 2		0.1
Chan 3		0.0

Cusor Value: 0.1

data: 0

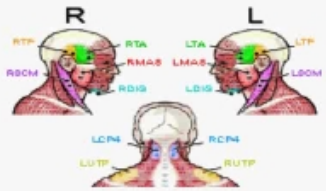
Color

Right Bars

700 uV

2.6 10.3

Bite Test
- Perform calibration if necessary.
- Press ENTER to start recording.
- Perform the measurement.
- Press ENTER again to stop recording.



Left Bars

700 uV

6.3 4.1

Right Signals

1 RTA 0..700

3 RMAS 0..700

0.0 10.0 sec

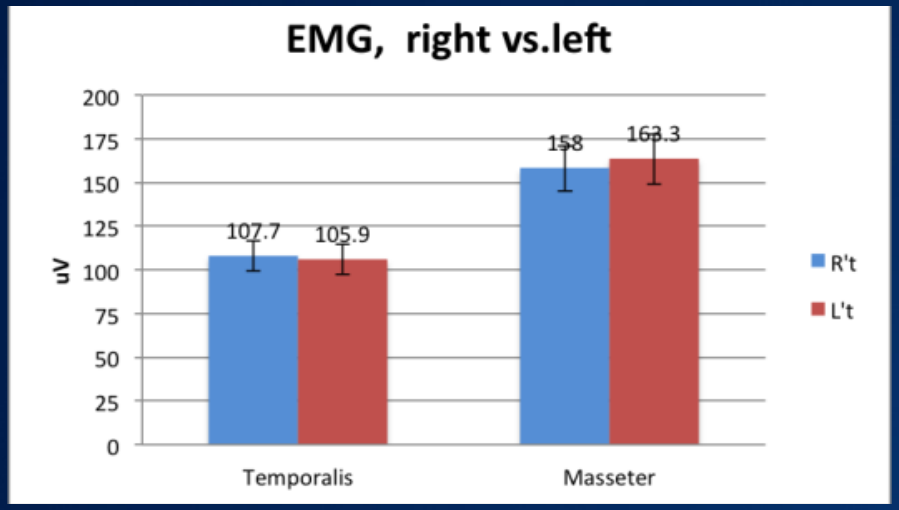
Left Signals

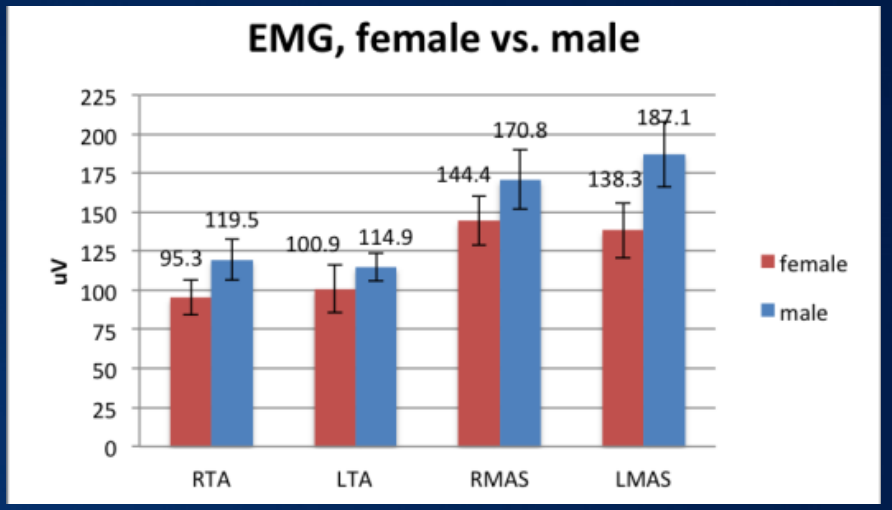
2 LTA 0..700

4 LMAS 0..700

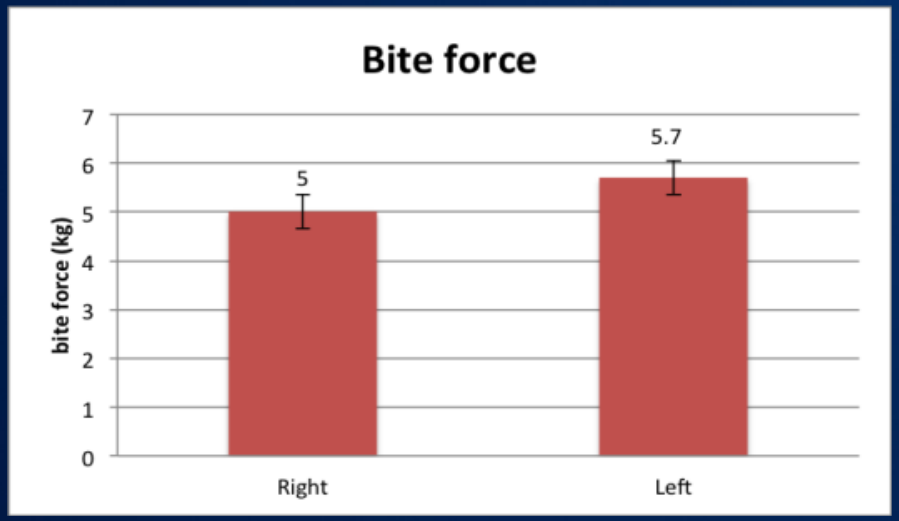
0.0 10.0 sec

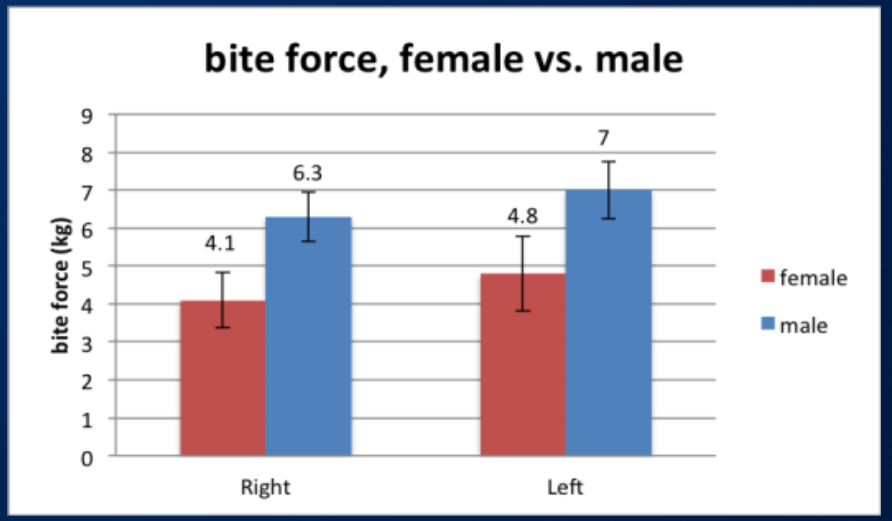
Results





No significant difference of EMG signal between right and left , female and male

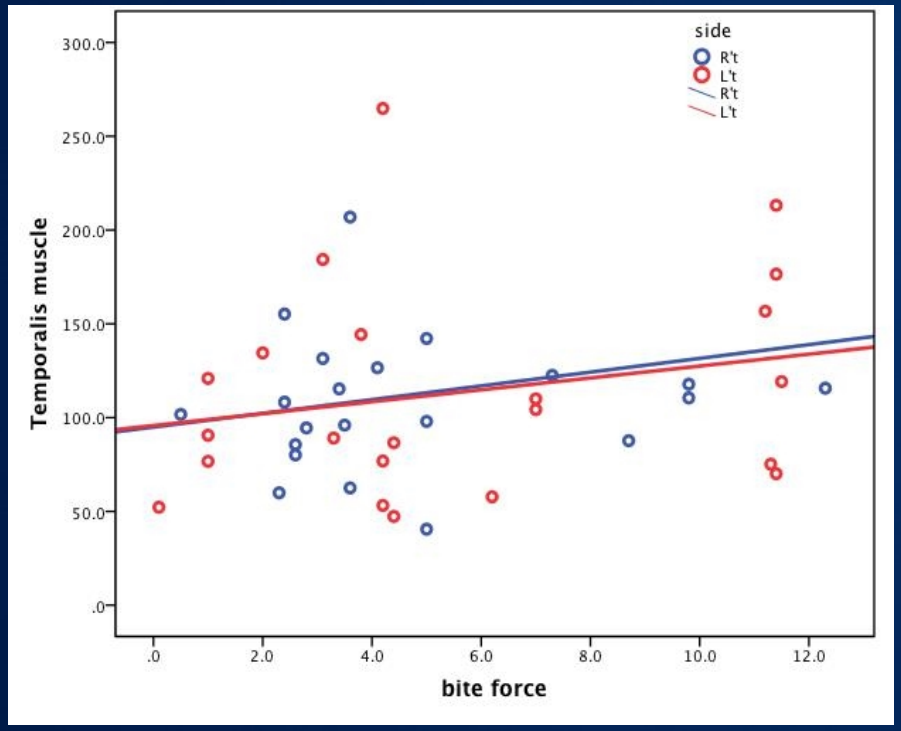




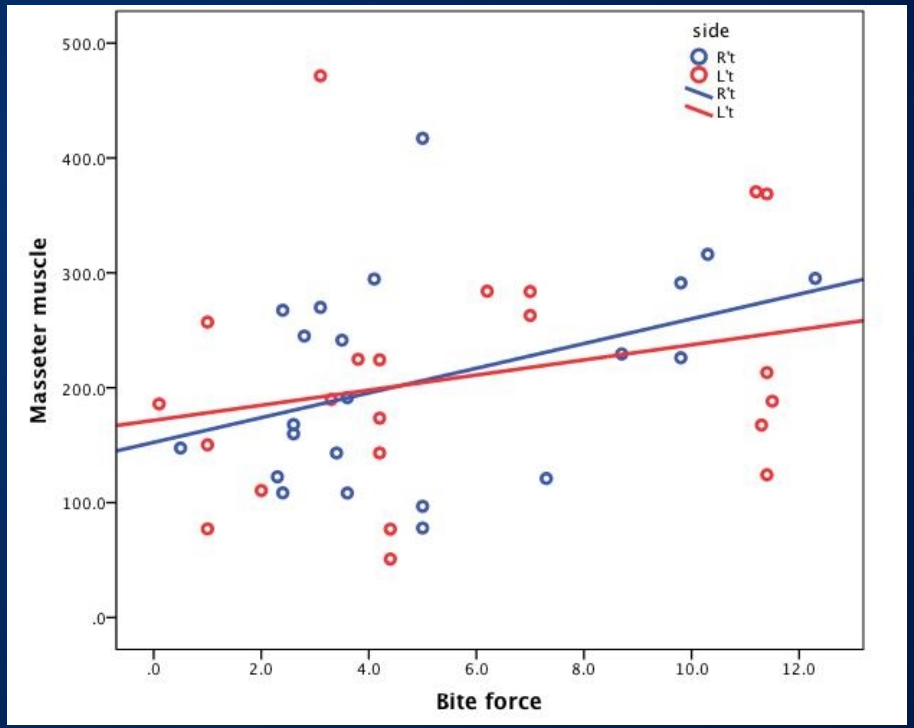
No significant difference of bite force between right and left , female and male

EMG vs. bite force

Temporalis



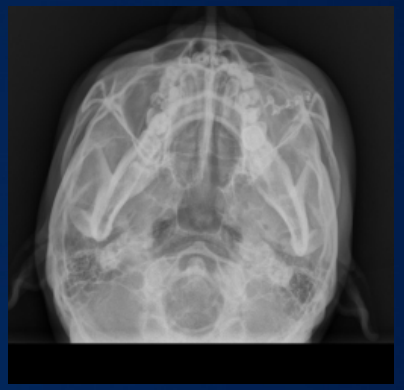
Masseter

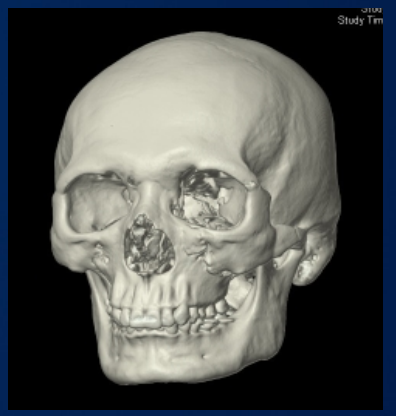


Case report

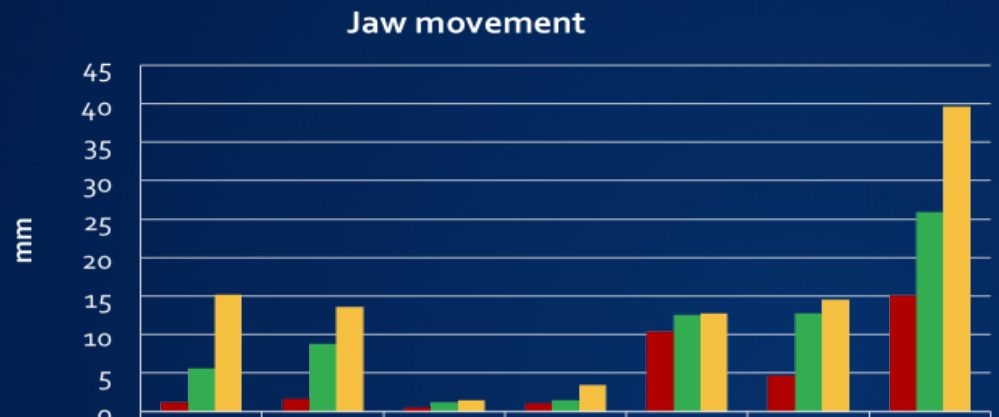
Case report

- 22 year-old man, motorcycle accident
- Left zygoma closed fracture
- Open reduction and fixation five days later
- Post-op followed-up at 1,3,6 months

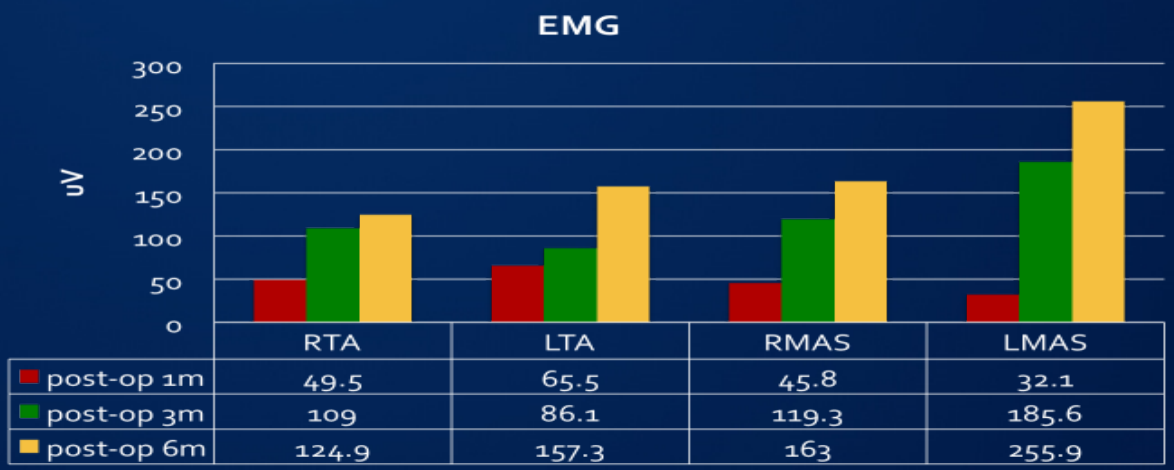




Post-op follow-up



	CPL_R	CPL_L	CRL_R	CRL_L	IRL_R	IRL_L	MOC
post-op 1m	1.2	1.7	0.5	1.1	10.4	4.7	15.1
post-op 3m	5.6	8.8	1.2	1.5	12.6	12.7	25.9
post-op 6m	15.2	13.6	1.5	3.4	12.7	14.5	39.6



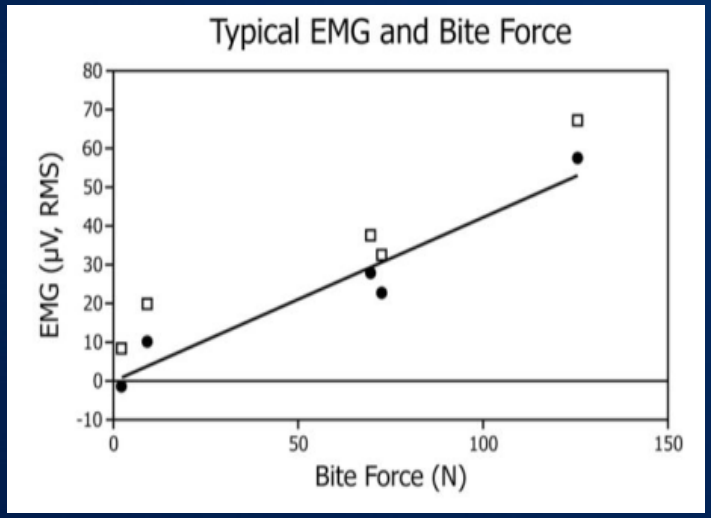
	RTA	LTA	RMAS	LMAS
post-op 1m	49.5	65.5	45.8	32.1
post-op 3m	109	86.1	119.3	185.6
post-op 6m	124.9	157.3	163	255.9

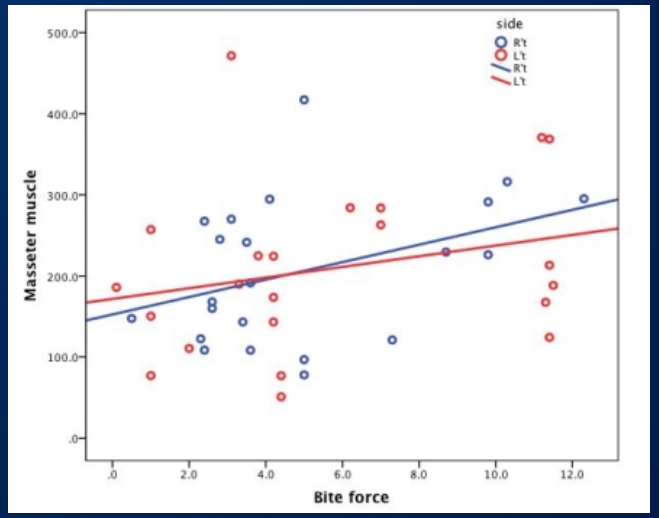
DISCUSSION

Correlation

- Slopes of the EMG activity versus bite-force for a given biting situation were reliable for temporalis and masseter muscles.

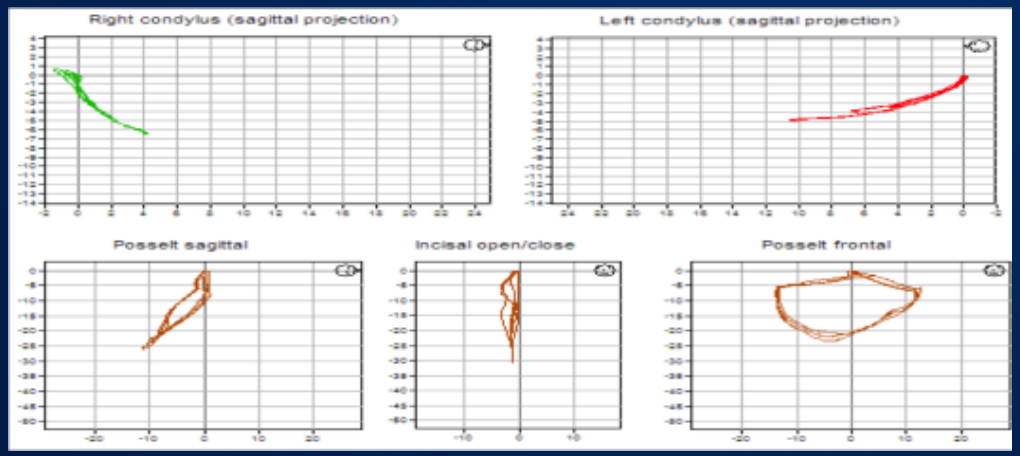
Eur J Oral Sci. 2011 June; 119 (3):219-224

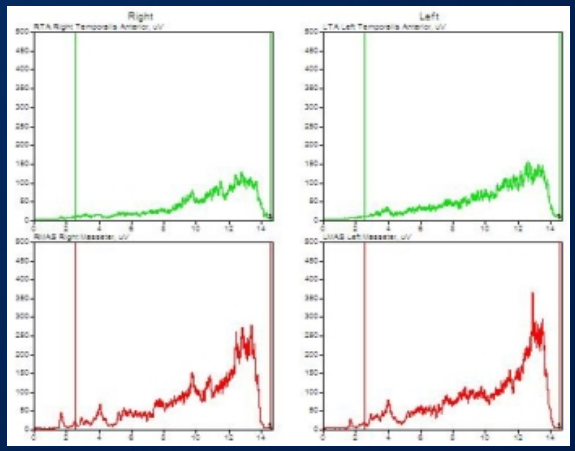




Variability

- Inter-measurement variability was low
- Intra-subject and Inter-subject variability
  - Use one side more than the other?
  - No significant difference between right and left
- Unilateral craniofacial deformity or facial trauma





Advantage/disadvantage

advantage	disadvantage
Non-invasive Not time-consuming(40 minutes) Not heavy Easy to understand Instant Visual feedback Testing and educating	Hard for Old people or children Edenturous people Only for alert patient

Conclusion

- Reliable, quantitative and noninvasive system
- Dynamic, continuously, biofeedback
- No significant difference between female and male, and bilateral condylar and incisal movement, EMG and bite force in young adults
- The mouth opening and closing ratio is about 6:4
- EMG and bite force has positive correlation
- Comprehensive evaluation of jaw function in kinematic, kinetic and functional way