

## ADJUSTING OF A STABILIZATION SPLINT BY THE USE OF T-SCAN III - BIOEMG INTEGRATED SYSTEM

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### Abstract:

**Introduction.** Occlusal splint, a well-established form of therapy, has been reported by many authors to have a beneficial effect on craniomandibular disorders. The articulating paper used to adjust the occlusal appliance is incapable of measuring timing sequence, occlusal force and pressure. The only way to precisely measure occlusal forces and time is the T-Scan III.

**Case report.** There is presented a case of a patient with myogenous craniomandibular disorder. A stabilization splint (full coverage splint) was constructed in the maxilla and the appliance was adjusted according to data provided by the T-Scan III-BioEMG integrated system.

**Results.** Computer guided occlusal adjustments ensure improved force and time dynamics to balance and better adjust the splint occlusal surface, confirmed by improved electromyographic activity and relief of symptoms.

**Conclusions.** (a) The concept of neuromuscular dentistry is one of great topicality. The integrated T-Scan III - BioEMG system as part of this approach has been proved useful in monitoring the oral rehabilitation treatment ; (b) The use of these computer-assisted diagnostic systems put the treatment on scientific bases and thus the rehabilitation is an evidence-based one.

**Key words:** Stabilization splint, T-Scan III, BioEMG

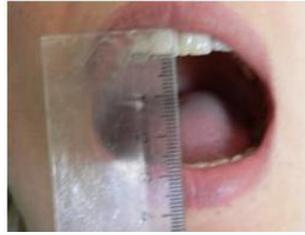
### INTRODUCTION

The efficacy of conservative occlusal therapy through splints is a controversial topic. A number of relevant studies have highlighted the therapeutic efficacy of these occlusal appliances [1,2,3,4], others have reported contradictory results [5,6,7] and others have denied the usefulness of such of therapeutic means in craniomandibular disorders [8]. As a great part of craniomandibular disorders involves the masticatory and cervical neuromuscular system and on the other hand the occlusion assessment as etiologic factor is controversial, we used an approach of patients which include the use of modern investigations specific to neuromuscular dentistry: the T-Scan III version V ( Tekscan Inc<sup>®</sup>) and the BioEMG II ( Bioressearch Assoc Inc<sup>®</sup>) This integrated system allows the precise

monitoring of muscular behavior in relation to occlusal factors. The T-Scan III allows the evaluation of timing of occlusion, the occlusal forces distribution as well as their balance [9]. The average integrated electromyographic data analysis provided by the T-Scan III system is useful to check and adjust the stabilisation occlusal splint.

### CASE REPORT.

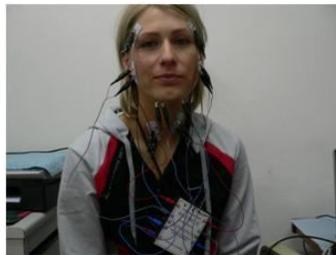
Gy.M. patient, 23 years old, has presented a charging characteristic symptoms of craniomandibular disorder: diminished limit of mouth opening ( 29 mm, elastic end-feel), localized morning pain in the areas of masseter and temporal muscles, joint noises. Based on clinical examination, the diagnosis of myogenous craniomandibular disorder was considered (fig.1)



**Fig.1** Diminished limit of mouth opening (29 mm)

A stabilization maxillary splint was made as first therapeutic step. In order to avoid arbitrary adjustments of the occlusal appliance we used the T-Scan III occlusal

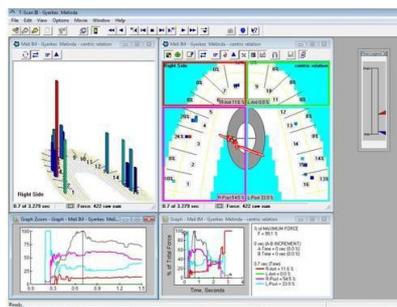
analysis system and the electromyographic records at rest and in centric occlusion both before and after splint wearing.



**Fig.2.** The BioEMG II device allows for the simultaneous examination of eight muscles.

At the first visit the emg examination showed a slightly increased rest activity of the right temporal muscle while the T-Scan analysis found a predominant distribution of occlusal contacts on the right side (62.2% on right side, 32.8% on

left side), with a clear shift of the center of power to the right (fig.3) The most pregnant occlusal contact was recorded on the first upper right molar in the central fossa area ( 23% of the entire occlusal force of the dental arch)



**Fig. 3.** The T-Scan III analysis of the patient

The electromyographic examination showed an increased rest activity of the

right temporal and digastric muscles ( fig.4,5)

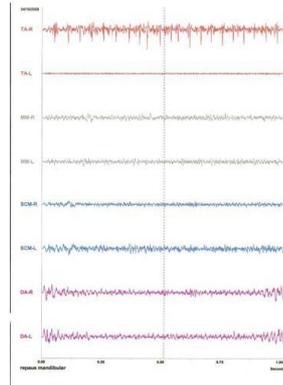


Fig. 4. Increased rest emg activity in right temporal and digastric muscles

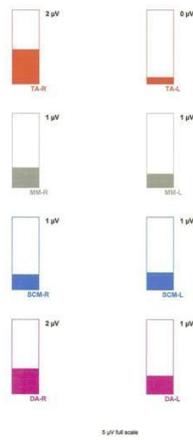


Fig. 5 Graphic representation of increased electromyographic rest activity at the the right temporal and digastric muscles

In centric occlusion an important muscular unbalance with predominance toward the right side can be observed ( fig. 6,7,8).

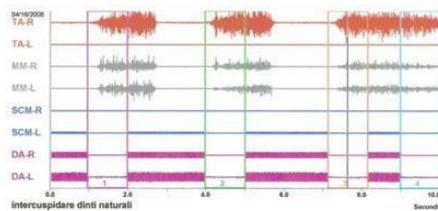
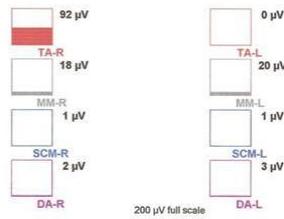


Fig. 6. Electromyographic activity in centric occlusion

Ave. $\mu V$	↔	%	Window 1		Window 2		Window 3		Window 4	
			$\mu V$	ms						
TA-R	58.1		45.8	0	60.4	0	62.9	0	63.4	0
TA-L	0.4	-1% -3%	0.5	777	0.4	862	0.3	809	0.4	1007
MM-R	17.9	-31%	25.9	75	18.8	89	15.1	244	11.6	25
MM-L	15.8	-85%	22.1	79	11.5	576	14.8	409	14.7	16
SCM-R	1.1	-77%	1.2	777	1.1	862	1.1	809	1.1	1007
SCM-L	1.5		1.5	777	1.6	862	1.4	809	1.3	1007
DA-R	2.8	-65%	2.9	777	3.0	862	2.7	809	2.5	1007
DA-L	4.2		4.6	777	4.3	862	4.1	809	3.9	1007

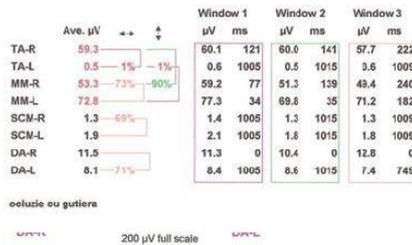
Fig. 7 The muscular unbalance in centric occlusion showed by the predominance of electromyographic activity toward the right side



**Fig. 8** Graphic representation of the muscular activity distribution in centric occlusion

The stabilization splint fabrication and its usually adjustment with the aid of articulating paper failed to improve the symptomatology and the occlusal force

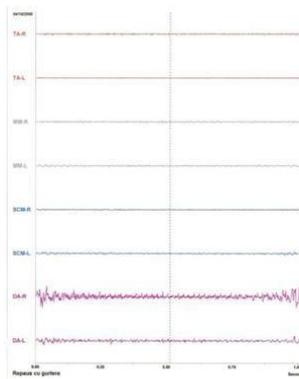
distribution. The electromyographic activity showed the same predominance of the right side (9).



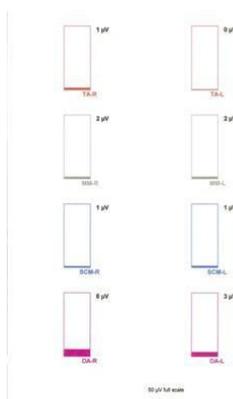
**Fig. 9** The muscular activity after the splint insertion. An important imbalance in centric relation toward the right side (90%) can be observed.

But in rest, after the insertion of the stabilisation splint the electromyographic

activity considerably decreased ( fig. 10,11)



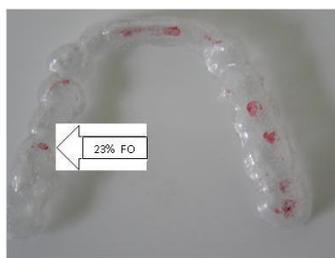
**Fig. 10** Rest electromyographic activity after the splint insertion: significant improvement of the rest activity, with a slight increased activity of the right digastric muscle.



**Fig. 11** Graphic representation of the rest electromyographic activity after the stabilization splint insertion

Checking with articulating paper of the occlusal surface of the stabilization splint showed the unequal distribution of the occlusal contacts ( fig 12), but this

topographic situation was not correlated with the data provided by the T-Scan III – BioEMG integrated system.



**Fig. 12** The image of occlusal contacts on the splint. A predominant left side distribution of contacts can be observed, but the T-Scan III examination revealed that in fact the greatest force level is situated on the right side at the teeth 1.6. ( 23% of the entire occlusal force !).

After the splint adjustment a more balanced distribution of the center of force was obtained (40% on the left side and 60% on the right side), as well as an

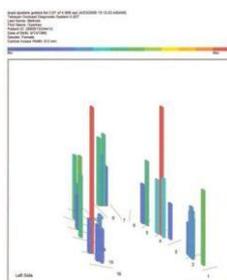
increased symmetric number of contacts on the splint occlusal surface (fig.13,14,15)



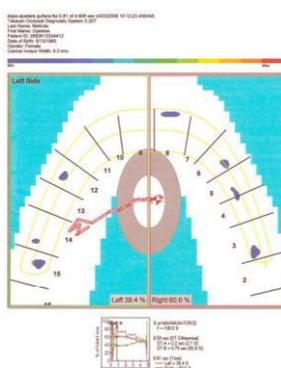
**Fig. 13** The more balanced distribution of the occlusal contacts on the splint surface

From an electromyographic point of view, the therapeutic succes of the splint therapy was confirmed by the significant decrease of the rest activity. Also, after 3-4 days of

splint wearing the complete disappearance of subjective and objective signs of dysfunction could be observed.



**Fig. 14** T-Scan III examination after the splint insertion : the more balanced repartition of the contacts on the splint can be observed



**Fig. 15** Despite the predominance of muscular activity on the right side, the T-Scan III examination showed a correct situation of the center of force after the splint adjustment

The current literature data, evaluated through the prism of scientific evidence, clearly suggest that the stabilization splints used in the craniomandibular disorders management to change de craniomandibular relations have primarily a behavioral therapeutic effect and not a mechanical one [10]. Actually, a deliberate induction of a change in vertically and horizontally craniomandibular relationships can be an issue because usually this modification requires subsequent adjustments of the occlusion. The relevant literature support the behavioural effect of the splint therapy whereas the results of several studies showed that the patients who have used these devices had better or equal results compared with subjects who have resorted to other similar therapeutic means such as biofeedback or relaxation therapy[11,12]. Considering all pro and con available data, it can be concluded that the oral stabilization appliance has sufficient

evidence to support its use for the management of localized myalgia and arthralgia of the masticatory system. It is much less likely to induce an inadvertent malocclusion, which is a strong negative consideration when the clinician is considering using the repositioning appliance. The use of mandibular repositioning appliances to treat craniomandibular disorders is not supported by the scientific literature

## CONCLUSIONS.

(a) The concept of neuromuscular dentistry is one of great topicality. The integrated T-Scan III - BioEMG system as part of this approach has been proved useful in monitoring the oral rehabilitation, including the stabilization splint adjustment ;

(b) The use of these computer-assisted diagnostic systems put the treatment on scientific bases and thus the rehabilitation is an evidence-based one.

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