THE IMMEDIATE EFFECT OF THE AQUALIZER® HYDROSTATIC SPLINT ON THE MASTICATORY MUSCLES ACTIVITY AND POSTURAL BALANCE

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Abstract

The correlation between the body posture and dental occlusion is well known. The aim of this paper is to highlight the effect of the immediate application of a hydrostatic splint on the postural balance and masticatory muscles activity. Material and method: Fifteen subjects were included in this study and they were examined by means of surface electromyography and posturometric assessement. The Mann Whitney U test was applied to compare the obtained results before and after the insertion of the Aqualizer® splint. Results: No statistically significant differences in the electromyographic activity and the postural balance after the immediate insertion of the hydrostatic splint could be observed ($p > 0.05$).Conclusions: In the limits of the present study, there are no significant differences in the masticatory muscles electromyographic activity and in the postural balance immediate after the insertion of Aqualizer® splint. Further investigations concerning the immediate effect of the Aqualizer® splint on healthy as well as dysfunctional subjects have to be carried out.

Keywords: Posture, electromyography, masticatory muscles, Aqualizer®

Introduction

The correlation between the overall body posture and dental occlusion is promoted as a concept more than 40 years ago, when in 1969, Leman used first hydrostatic plates in the treatment of temporomandibular joint dysfunction (Lotti, 2010). This approach has gained importance with the promotion of the neuromuscular occlusal concepts as an alternative to the mechanical concepts of occlusion (Dawson, 2007; Franco et al., 2001).

After the congress having as topic " Postura, occluzione e salute " (Milan, 1997) has established a definite link between posture, occlusion and temporomandibular joint status, the posturology has gained increasing importance in oral rehabilitation (Ciancaglini, 1999). For mutual correction of the postural and occlusal problems, the practitioners returned to the above principles of Leman, so the Aqualizer® appeared as the first commercial device, simple and effective, for neuromuscular deprogramming. It is based on the principle of communicating vessels using periodontal proprioceptive sensitivity as a feedback mechanism to balance masticatory muscles (Bakke et al., 1992; Bakke, 2003; Lerman, 2001; Kinderknecht et al., 1992; Nordstrom, 2000).

The purpose of this study is to highlight the influence of the immediate application of the Aqualizer® on postural balance and the masticatory muscle activity.

Material and methods

Fifteen subjects, without signs or symptoms of craniomandibular disorders, aged 24 - 40 years (6 M, 9 F) were included in this study, after receiving their informed consent. Posturometric evaluation before and after immediate insertion of a hydrostatic splint (Aqualizer®) were performed, by means of two electronic weigs with the same calibration (fig 1) , in order to assess the postural balance on the two legs.

Electromyographic records of the masseter and anterior temporal muscles at rest and during mild isometric contraction, before and after immediate insertion of the Aqualizer® device, were made using the BioEMG II electromyograph (BioResearchInc, Milwaukee) (fig. 2,3,4). The mean amplitude of the signals in all of the registration conditions, as well as the results of the postural balance examination, were enrolled tables.

Fig.1. The postural balance evaluation

Fig.2. The electromyographic examination

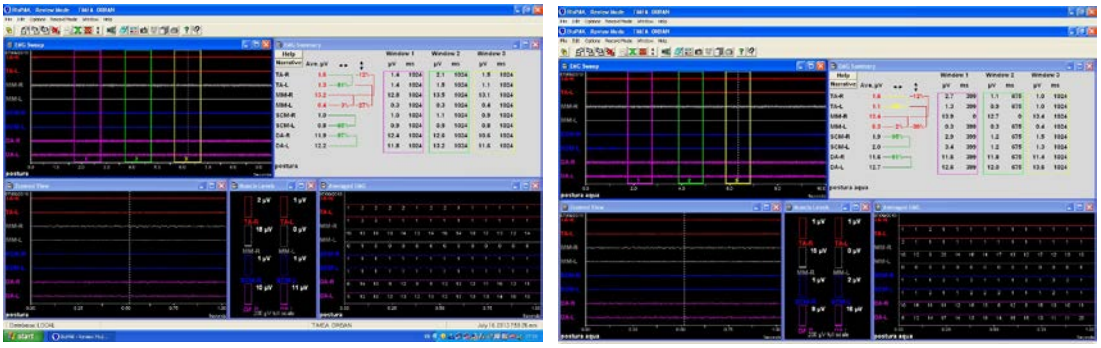
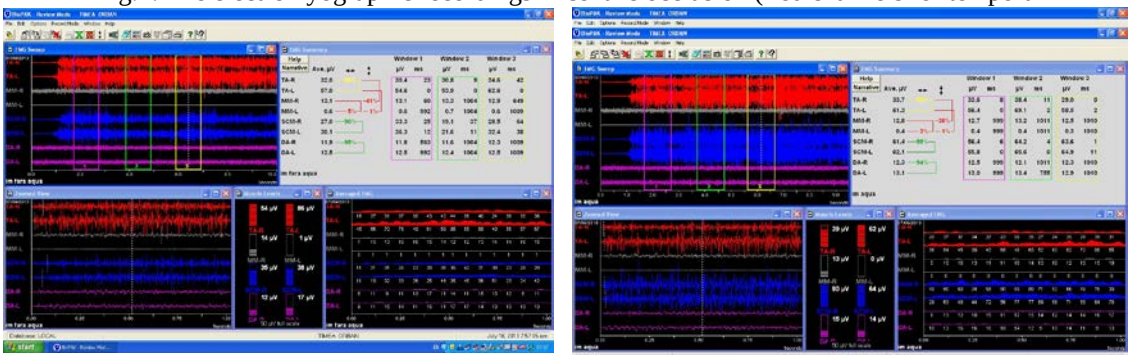


Fig.3. The electromyographic recordings at rest without and with Aqualizer (red channels for temporal and blue channels for the masseter muscles !)

Fig.4. The electromyographic recordings in centric occlusion (red channels for temporal



and blue channels for the masseter muscles !)

The statistical analysis of the obtained data was performed by means of NCSS Dawson Edition program. The unpaired nonparametric Mann

Whitney U test was applied to compare the electromyographic data obtained before and after immediate insertion of the occlusal device, as well as the postural balance right-left before and after the insertion of the Aqualiser®. The null hypothesis is that there is no difference between the picked data before and after immediate insertion of the hydrostatic splint. The significance level was considered at p=0.05.

Results

The electromyographic mean activity in masseter and temporal muscles in centric occlusion and at rest before and after immediate insertion of Aqualiser® are shown in the table no. I. No statistically significant differences after the immediate insertion of the hydrostatic splint could be observed. As well, regarding the postural differences (table no.II), no significant difference between the two conditions was observed (p= 0.57). So, the null hypothesis of the study was accepted.

Table no.I. The electromyographic mean activity (in microV) of the studied muscles before and after immediate insertion of the Aqualizer®

Subject	*CO without Aqualizer*				*Co with Aqualizer*				*Rest without Aqualizer*				*Rest with Aqualizer*			
	Tr	Tl	Mr	Ml	Tr	Tl	Mr	Ml	Tr	Tl	Mr	Ml	Tr	Tl	Mr	Ml
H. T.	51	22	72	58	20✷	16✷	53✷	21✷	1	2	1	2	1	2	1	1✷
U. H.	32	63	51	36	43✷	34✷	33✷	34✷	1	1	4	3	1	2↗	10↗	7↗
C. A.	64	65	51	37	48✷	47✷	62✷	27✷	3	2	1	1	2✷	2	1	2↗
C. M.	87	59	52	74	22✷	14✷	18✷	21✷	5	2	1	2	3✷	4↗	5↗	6↗
C. A.	119	148	50	41	75✷	92✷	28✷	46	1	6	2	3	4↗	2✷	11↗	8↗
C. D.	17	23	63	69	4✷	5✷	10✷	28✷	1	1	2	3	1	2↗	2	3
C. D. s	42	30	21	29	84	65	17	33	2	2	4	3	2	1✷	2✷	2✷
D. S.	49	58	117	110	52	35✷	95✷	91✷	1	3	1	1	1	3	1	2↗
H. A.	48	33	35	19	21✷	38	27✷	24	1	3	2	1	1	1✷	1✷	1
J. K.	290	244	291	197	221✷	162✷	269✷	159✷	2	2	1	1	2	1✷	1	1
O. T.	36	59	27	43	39	70	73	76	2	1	1	1	1✷	1	2↗	2↗
O. I	33	9	10	32	70	31	29	43	2	2	1	2	1✷	1✷	5↗	1✷
S. A.	142	97	90	85	60✷	22✷	78✷	58✷	2	2	1	1	1✷	1✷	1	2↗
S. C	34	25	5	8	35	49	11	26	2	2	2	1	1✷	2	3↗	2↗
V. I	165	140	176	183	46✷	14✷	43✷	44✷	1	2	2	4	3↗	3↗	5↗	14↗

✷ decreased activity ↗ increased activity

Right temporal : p= 0.40 ; Left temporal : p= 0.27 ;
Right masseter : p= 0.44; Left masseter : p=0.31

Table no.II. The postural differences (in kg) with and without Aqualizer®

Subject	*Posture without Aqualizer*		*Posture with Aqualizer*		*Postural difference without Aqualizer*	*Postural difference with Aqualizer*
	Left	Right	Left	Right		
H. T.	65.00	69.00	64.00	71.00	4.00	7.00
U. H.	29.20	28.80	31.70	26.90	0.40	4.80
C. A.	59.00	42.00	59.00	43.00	17.00	16.00 ✷
C. M.	30.40	36.20	37.00	38.70	5.80	1.70 ✷ ✷
C. A.	26.00	30.00	26.00	32.50	4.00	6.50
C. D.	27.10	30.40	24.70	32.70	3.30	8.00
C. D. s	25.90	22.30	24.00	24.60	3.60	0.60 ✷ ✷ ✷
D. S.	34.00	32.00	34.30	34.10	2.00	0.20 ✷ ✷ ✷
H. A.	25.00	31.00	27.30	26.40	6.00	0.90 ✷ ✷ ✷
J. K.	25.00	30.00	22.00	34.00	5.00	12.00
O. T.	27.30	30.00	27.00	30.00	2.70	3.00
O. I	21.00	22.50	21.70	21.80	1.50	0.10 ✷ ✷
S. A.	45.60	46.10	46.00	46.30	0.50	0.30 ✷
S. C	24.70	25.00	26.10	25.00	0.30	1.10
V. I	30.60	23.00	27.10	26.40	7.60	0.40 ✷ ✷ ✷

✷ slight difference reduction ✷ ✷ important difference reduction
✷ ✷ ✷ very important difference reduction

Discussions

It is very difficult to realize a hard or soft occlusal appliance without interferences, as well as to obtain the neuromuscular balance. The hydrostatic splint allows the patient, using his own reflex function, to avoid the dental interferences and also to correct his equilibration. The electromyographic results of this study are partially consistent with those of other studies, an improvement in neuromuscular activity, immediate after the Aqualizer® insertion, being obvious, but without reaching a statistically significant level. Although the study group was a small one and without any craniomandibular disorder, in more than 50% of subjects a predictable muscle activity in central occlusion immediate after the splint insertion, in terms of a decrease of electromyographic activity in elevators, could be observed. Biavati and Guida (2002; Biavati, 2003) obtained good results for the cases of myogenous and myoarthrogenous pain in 8 minutes on average after the insertion of the Aqualizer® and they considered the results much better than those obtained from TENS. The Aqualizer® induced also postural changes, a shift to the left or to the right being observed, which reduced de weight imbalance in half of the studied cases (table no. II). This

is also consistent with other studies (Ciancaglini et al., 2003; Szasz et al., 2010).

At rest, the electromyographic activity of temporal muscles remained in most of the subjects unchanged, or a decreased activity could be observed. The increased electromyographic activity at rest, especially in the masseter muscles, could be the effect of the appliance thickness and the contact of the appliance with the opposite teeth (Glassman, 2002). Although the results for the entire group have not a statistically significant level, from a clinical perspective, they suggest in many of the studied situations a definite improvement concerning both the masticatory muscles activity at rest and in centric occlusion and the postural equilibration. Further investigations concerning the immediate effect of the Aqualizer® splint on healthy, as well as dysfunctional subjects, have to be carried out. These studies may contribute to the understanding of the adaptation mechanism triggered by this hydrostatic occlusal device.

Conclusion

In the limits of the present study we can conclude that, from a statistical point of view, there are no differences in the electromyographic activity of the masticatory muscles and the postural balance, immediate after the insertion of a hydrostatic splint. For more accurate conclusions, the efficiency of the hydrostatic occlusal appliance has to be individually assessed, in healthy and dysfunctional patients, as well.

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