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Case Report

Bite & Swimming: Serranus

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Abstract

Craneo-occlusal balance can improve sport performance. Does this also apply to swimming?

Two competitive swimmers wore occlusal splints (Serranus: individual oral appliance) during training and competitions, in an attempt to improve their performance.

The athletes wore the appliance during one season (2013-2014), and we observed their swimming technique, run tests, took videos and photos.

Tests carried out showed an improvement in propulsive efficiency and a decrease of lactic acid parameters. Coaches observed an improvement in the swimmers' performance, both during training and during races.

ABBREVIATIONS

m: Meter

INTRODUCTION

Several sports are focusing their attention on the collateral health complaints that may occur alongside the health benefits [1]. The main oral issues linked to the performance of different sports, and in particular swimming, are gnathologic disorders, trauma, caries, erosion, dental stains, changes in the level of S-IgA [2].

An asymmetry of the skeletal system can lead to a disharmony of the muscular system.

Posture indicates the equilibrium/balance between the forces acting on the body: equilibrium, economy and comfort (absence of pain) [3].

With the term "posture" we mean a position of the body or of a body part but also an attitude, a pose and a characteristic way of bearing one's body at a psychological, emotional and physical level. No evidence are reported [4].

In some people, postural alterations caused by malocclusion or by bad functioning of the craneo-mandibular-vertebral system can decrease performance and increase injuries.

Perfect coordination is necessary to obtain outstanding athletic performance, and coordination is based on complex connections between nerves and hormones. A correct posture leads to a perfect coordination [6].

E. Lazzari [5] says that posture is a dynamic balance supervised by receptors. Receptors are much more sensitive in an aquatic environment than in an aerial environment, which means that the body has much more information to record and to respond to when under water [5].

Motor coordination is a combination of complex tasks that are performed at different levels; the central nervous system is involved, as well as muscles and receptors.

The lack of occlusal stability could cause a break energetic line resulting in an unbalance between agonist and antagonist muscles connected by synergic chain [7].

Only few clinical studies have been conducted to try to demonstrate that the use of bites can improve sports performance, by means of craneo-occlusal balance [1].

The aim of this study is to prove that the use of an intra-oral device can balance the structures, and can lead athletes to better occlusal stability and a consequent higher resource of energy.

CASE PRESENTATION

First, it was necessary to design and fabricate a bite appliance that athletes could wear without impacting their breathing. This appliance (Serranus) was fabricated by moulding athletes in different positions (lying down, standing up, seated) and places (dentist's chair, gym, swimming pool).

Two senior competitive swimmers enrolled into the research, they went through medical examinations, where their medical history was fully reviewed, and we took photos, waxes and impressions. We got an informed consent from the athletes, in accordance to the requirements of the Ethics Committee.

We carried out tests throughout the year to evaluate the athletic performance. In addition, we took photos and videos during the training sessions.

We ran the following tests: 5x300 in front crawl (increasing speed at every lap); and 8x50 in the swimmer's preferred style (also increasing speed at every lap).

We noted the time of each 25-metre lap, the stroke rate and the lactate with and without orthodontic appliances.

We measured blood lactate [8] with Lactate Scout before starting the test, after every lap and 1 minute after the end of the test.

From time and frequency, we obtain the speed, the propulsive efficiency, and the distance for stroke.

A Vacuum Formed (Essix) Retainer of 0,5 mm was fabricated and the athletes wore it from the first training.

Using the original results (from wax, Essix and medical examinations), we designed an appliance (Serranus), which was tweaked throughout the year.

To avoid placebo effect, the swimmers wear a Essix instead of the device and taking test.

The athletes and coaches were never informed about the possible effects of the appliance.

Athlete Number 1 was a backstroke swimmer (200 m). She had irregular swim in all styles. She presented a malocclusion with asymmetry, deep bite and crowding. In addition, she suffered from old postural problems in her back and neck with a tendency to inflammation. The athlete had never had an orthodontic treatment.

Athlete Number 2 was a breaststroker swimmer (200 m). She had regular swim, with a slight asymmetry of the shoulder. She presented a good occlusion with some crowding; she had had an orthodontic therapy in the past and was wearing a mobile retainer. She suffered from frequent shoulder inflammation, which made her miss a few training sessions during the season.

Tests (Tables 1, 2, 3, 4) showed an improvement in propulsive efficiency (PE), especially over longer distances and at low speeds (Table 1,3). We also noticed a decrease of lactic acid parameters (Figures 1-3).

The coaches observed an improvement in the swimmers' performance, both during training sessions and during races.

Table 1: [Test 5x300 increase crawl - Athlete 1].

5x300 1	NO BITE 0 ott 2013			BITE ott 2c013			Δ EP 1-0	BITE gen 2014			Δ EP 2-0
	Tempo	F	EP	Tempo	F	EP		Tempo	F(i)	EP	
1°	4,03.46	31,4	7,20	3,59.58	31,19	7,69	+0,49	4,07.14	29,33	8,50	1,3
2°	3,55.11	32,2	7,55	3,51.81	32,78	7,55	+0,00	3,57.84	30,46	8,31	0,76
3°	3,49.43	33,2	7,54	3,50.58	32,94	7,58	+0,04	3,50.65	31,85	8,18	0,64
4°	3,47.74	34,1	7,22	3,47.65	34,04	7,31	+0,09	3,44.21	33,52	7,9	0,68
5°	3,46.93	34,3	7,21	3,46.61	34,75	7,05	-0,16	3,41.50	34,41	7,74	0,53

Abbreviations: F: Frequency; T: Time; EP: Propulsive Efficiency

Table 2: Test 5x300 increase crawl - Athlete 2.

5 x 3 0 0 2	NO BITE Ott '13			BITE Nov '13			BITE gen '14			BITE apr '14			BITE lug '14		
	T	F	EP	T	F	EP	T	F	EP	T	F	EP	T	F	EP
1°	4,07.60	34,22	5,602	4,15.30	34,18	5,13	4,04.57	36,3	5,069	4,13.09	34,22	5,56	4,10.67	34,22	5,522
2°	3,56.44	35,8	5,68	4,02.80	35,22	5,490	3,54.09	35,22	5,755	4,02.11	35,8	5,766	4,04.37	35,8	5,370
3°	3,51.09	37,24	5,62	3,55.90	36,6	5,489	3,48.35	36,6	5,181	3,56.90	37,24	5,803	3,56.57	37,24	5,620
4°	3,46.16	38,08	5,711	3,51.10	38,3	5,266	3,47.13	38,3	5,206	3,52.09	38,08	5,955	3,52.68	38,08	5,723
5°	3,44.67	39,18	5,437	3,43.25	38,98	5,535	3,49.38	38,98	5,072	3,44.21	39,18	5,740	3,48.09	39,18	5,459

Abbreviations: F: Frequency; T: Time; EP: Propulsive Efficiency

Table 3: Test 8x50 increase backstroke - Athlete 1.

8x50 Ba 1<8	Gen 2014 BITE			Feb 2014 BITE			Feb 2014 NO BITE			Feb 2014 Essix		
A 1	T	F	EP	T	F	EP	T	F	EP	T	F	EP
1	41.49	24	12,53	41.21	24,41	12,349	41,96	27,97	11,136	42.18	24,19	11,842
2	40.52	25,57	11,646	39.74	27,38	10,516	41,05	23,88	13,328	41.94	24,03	12,089
3	39.43	27,07	11,1	39.18	27,08	11,3	39,52	26,65	11,428	39.59	26,12	11,886
4	38.18	27,87	11,400	38.18	29,3	10,148	39,18	27,46	10,957	38.74	27,48	11,298
5	37.27	29,68	10,59	37.18	30,84	9,743	37,62	29,41	10,552	38.21	27,31	11,911
6	36.78	30,16	10,614	36.43	31,49	9,864	37,40	30,16	10,097	37.84	28,66	10,969
7	35.93	31,59	10,222	35.93	32,63	9,472	37,11	30,78	9,858	37.05	29,67	10,816
8	35.30	33,01	9,704	39.74	33,83	8,853	37,11	31	9,692	36.99	30,44	10,204

	Feb 2014 BITE			Apr 2014 NO BITE			Mag 2014 Essix					
	T	F	EP	T	F	EP	T	F	EP			
1	42.02	22,96	13,437	43.43	23,35	11,685	40.62	24,55	12,79			
2	41.58	23,39	13,267	42.53	23,85	11,782	40.02	26,82	10,83			
3	39.99	24,89	12,867	40.27	26,05	11,316	38.40	27,93	11,22			
4	39.37	25,95	12,268	39.74	27,6	10,342	37.71	28,98	10,805			
5	38.14	26,9	12,418	38.68	28,9	10,083	37.58	29.34	10,725			
6	37.14	27,96	12,302	38.65	28,5	10,458	36.68	30,31	10,58			
7	36.62	30,32	10,61	38.58	29,25	9,9	36.30	31,7	9,865			
8	35.68	31,69	10,355	37.43	31,6	9,036	35.55	33,61	9,105			

Abbreviations: Ba: Back Stroke; F: Frequency; T: Time; EP: Propulsive Efficiency

Table 4: Test 8x50 increase breaststroke - Athlete 2.

8x50 Bre 1<8	Gen 2014 BITE			Feb 2014 NO BITE			Giu 2014 Essix		
A 2	T	F	EP	T	F	EP	T	F	EP
1	431.9	28	7,99	44.56	35,7	4,1	45.70	26,8	7,39
2	42.30	31,8	6,3	43.7	30,0	6,55	45.20	29	6,36
3	41.30	36,1	5,07	42.5	36,3	4,49	43.46	33,3	5,19
4	40.60	35,8	5,43	41.3	39,0	4,14	43.06	36,15	4,41
5	39.70	39,7	4,51	40.1	39,9	4,31	42.06	38,45	4,14
6	39.52	38,4	5,05	40.1	39,9	4,3	42.30	38,75	3,96
7	39.50	41,3	4,23	40.0	41,0	4,13	41.60	39,85	3,91
8	39.25	43,4	3,86	39.8	43,1	3,71	41.30	41,2	3,68

Abbreviations: Bre: Breast Stroke; F: Frequency; T: Time; EP: Propulsive Efficiency.

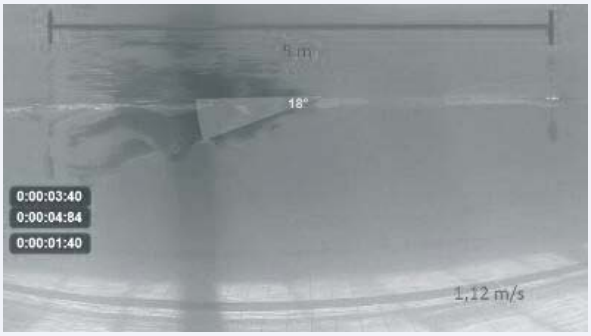

Figure 1 Waterline without bite.

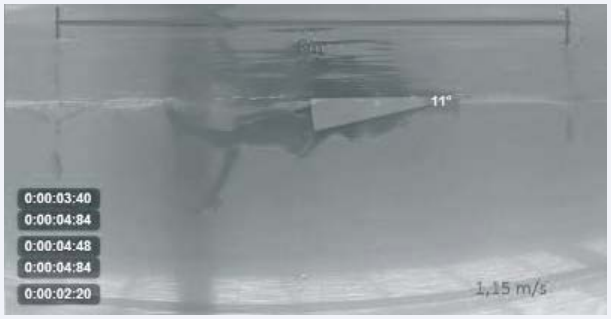

Figure 2 Waterline with bite.

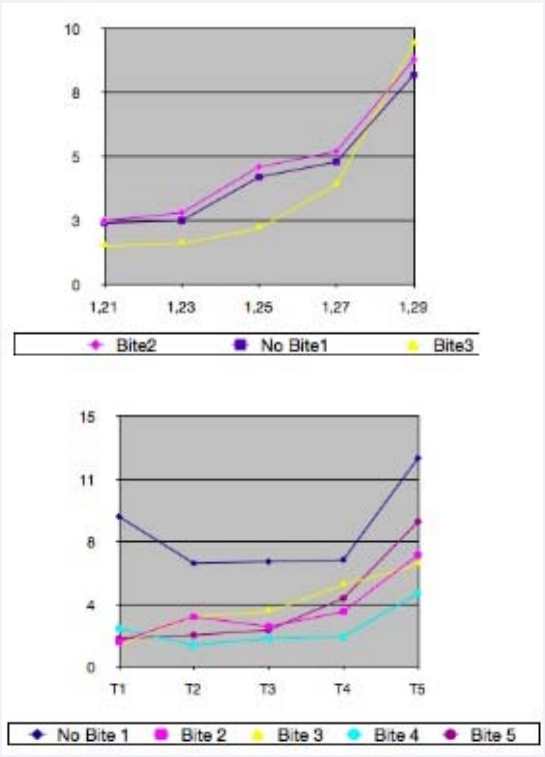

Figure 3 Lactic acid parameters from test 5x300 - Athlete 1 and 2.

Although one of the athletes stated that he did not notice any change, the results of the tests confirmed a significant improvement. The other athlete noticed a considerable difference in terms of applied and expressed force, fluidity and speed.

DISCUSSION

Occlusion can influence posture and movement.

In order to fabricate a bite that athletes could wear during swimming, we needed to consider all factors related to the sport (location, dynamics, muscles strength, regulations) and analyze occlusion and function.

It should also be kept in mind that changing this balance needs a settlement period during which the subject's conditions can worsen of the subject and then have, if adjustments exact have been corrected, improved rapidly and progressively until the settlement, the found new balance.

The sensitivity of athletes, especially if high-level, is a factor to account for, since altering the balance for professional athletes is not always well accepted.

The literature confirms and supports the usefulness of intra-oral devices to balance the muscles and consequently improve the trim and the energy consumption in the bio-mechanical function.

The results of this study, obtained observing athletes throughout the year, showed an improvement of bio-mechanical swimming (fluency, water-sensibility, floating, levity, efficiency, balance, trim, etc.), as shown in Figures 1,2. The numerical results of the tests are also shown in (Tables 1-4). The coaches confirmed these improvements.

In agreement with the literature1 relative to usage of bites during sport performance, this study demonstrates the same level of usefulness in swimming.

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