Analysis and Test reports of F7 technology

by PhD prof. Renzo Pozzo

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Udine, 08.11.2014

Subject: declaration of conformity

The undersigned Renzo Pozzo born in Codroipo ... on 01.05.1953 resident in Codroipo via D. Moro N. 7 c. A. p. 33033 aware, pursuant to Articles 75 and 76 of D. P. R. 445/00, that anyone who makes false statements, forms false acts or makes use of them is punished under the code criminal law and special laws

Declares

To be in possession of an international level academic training curriculum including the title of Ph. D. in motor and Sports Sciences.

To be active since the year 2000 at the aforementioned university as a professor in charge carrying out teaching and research activities.

To have carried out experiments concerning the application of devices called D-7 for the company SMS VIGOR D. o. 0 Kovorska cesta 59 / 4290 Trzic Slovenij have been summarized in the reports with the following titles and in stock with the administrator of the the company Stefano Mies:

1. Brief report on TMC treatments
2. Brief report on the tests of ascent with overload with and without the use of D-7. Report I
3. Brief report on the tests of ascent with overload with and without the use of D-7. Report 2
4. Brief report on the dynamic fatigue test at the horizontal press

In faith

Dr. Renzo Pozzo



REPORT ON
FATIGUE TEST
AND
COORDINATION TO
SIMULATOR OF F1

ANNEX NO.2

Test: Driving tests on the Formula-1 simulator at the Padua laboratory

Place: Bhai Tech (Padua) **Date:** 09 June 2015

Introduction:

The purpose of this study was to verify how the use of F7 technology (attached), here with the devices in Silicone F7 And Device F7, can influence the performance response and what are the muscular mechanisms that underlie these variations during a driving simulation on a professional simulator for the FORMULA-1 circuits

Protocol:

A former Formula 1 GP driver (still active as a test driver) and in excellent condition physics participated in the experiment. The exercise consists in carrying out 8 laps of a circuit included in the simulator protocols. The athlete conducted 3 test sessions with adequate recovery between them and using the devices appropriately applied in the second session of laps and with the "blind" method (athlete without information). The devices were positioned as follows: Silicone F7 on the regions of the rachis C7 and D12, the Device F7 on the ankles.

Experimental methods

The professional system of the simulator provides a series of data in real time and in telemetry of which, in this report, the effort applied on the steering wheel (torque) and that exerted on the brake pedal (brakes) have been considered.

A surface electromyography system (Biovision® operating at 1000Hz) was used for the analysis of muscle activation. The muscles analyzed are: soleus (SOL), hand flexor (FLEX), upper trapezius part (TRA) detected on both sides (left, right).

The electromyographic signal was treated with two analytical methods, one to evaluate its temporal characteristics and instantaneous intensity (**RMS = R**oot **M.**and **S.**quare). The other, to evaluate the total integrated activity (**IEMG**) of each muscle through the temporal integration of the RMS traces.

Setting of the executive conditions

The athlete was given a brief indicative questionnaire on the psychosomatic sensations relating to the experience of the individual trials.

- He was not aware of what effects the worn device could induce.
- He was not aware of when he used the devices ("blind" method).
- He was unable to set the machine with the characteristics suitable for him and all the tests were performed in the same initial setting condition. This made the differences even more significant results as the athlete has to adapt to an unfavorable condition.

Results

First of all, the main descriptive elements referring to the three tests performed in terms of type of errors are presented. As can be seen in table 1, the difference in the total value is significant.

Tab. 1 Values of errors made during the test sessions

Session (8 laps)	Devices	Spin	Straight	Total
1st Session	NO	8	2	10
2nd Session	YES	1	1	2
3rd Session	NO	6	1	7

Subjective parameters

On the psychosomatic sensations related to the proposed questionnaire, the athlete reported the following main observations:

- Clear difference in effort management between sessions with and without devices, obviously in favor of sessions with devices.
- Substantial decrease in the sensation of generalized fatigue in the presence of the devices.
- Greater reactivity in setting maneuvers of the coordination elements typical of the specialty (braking, cornering, accelerations).

Since the tests involved considerable differences in errors (head-tail, straight), depending on whether or not the F7 devices are used, some comparable results of some laps are discussed below.

Dynamic parameters

Figure 1 shows the temporal trends of the effort (torque) on the steering wheel and of the effort exerted on the brake pedal for the seventh and eighth laps considered in the session with and in the one without the F7 devices. The running time of the lap is clearly better in presence of the devices (upper panels). In the 7th lap 95 s with device and 108 s without devices; in the 8th round 106 s with and 123 s without devices. The graphs of lap 8 show some differences that correspond to behavior errors: without F7 devices a "straight" at about 10s, 2 intense braking at about 87s with little torque level.

Using the F7 devices there is a head-tail at about 32 s and another intense braking at about 45s. Despite the errors mentioned, total travel times are always better with F7 devices. Similarly, the travel times of the 1st lap are 105 s with, respectively 114 s without F7 devices.

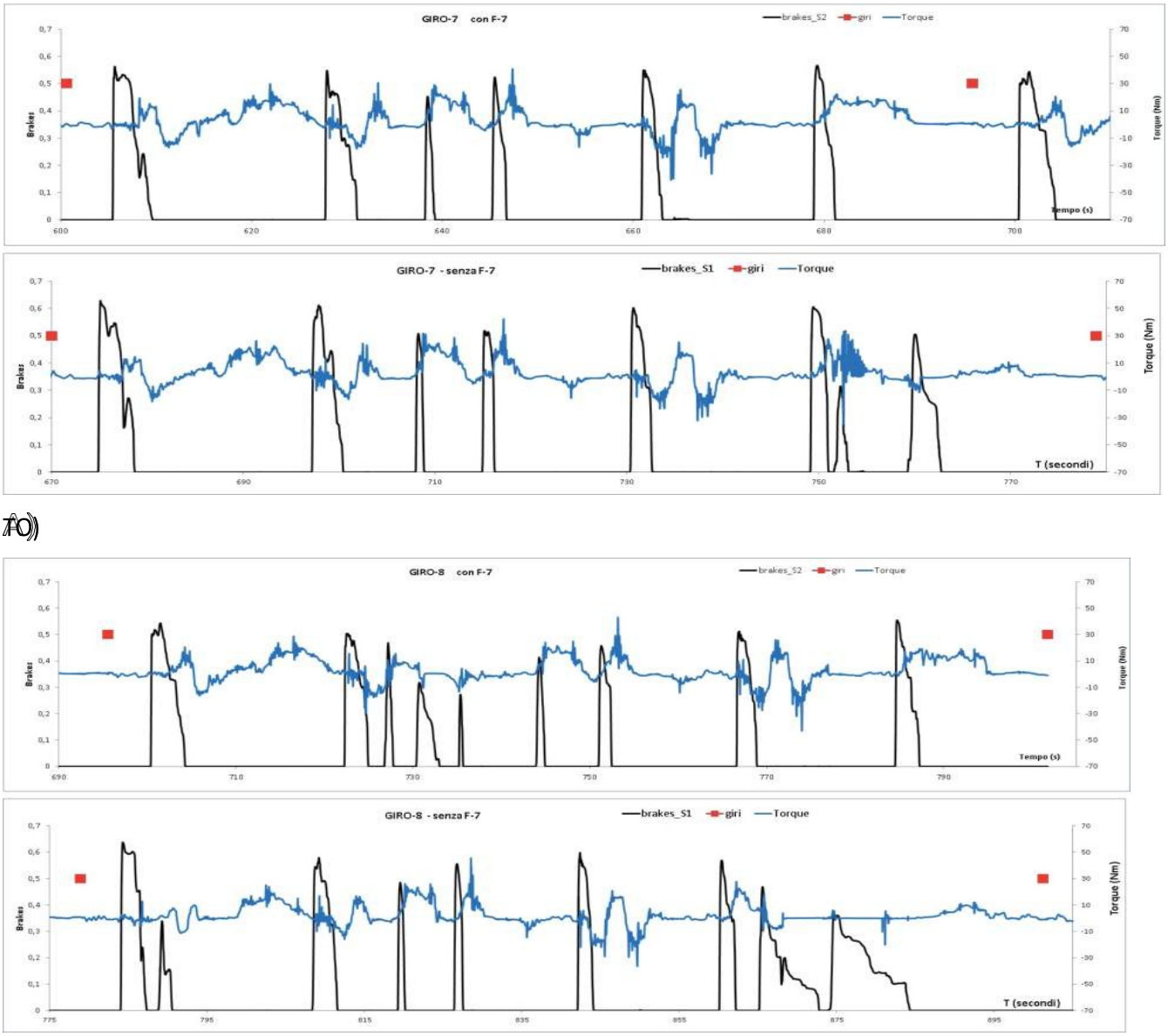


Fig. 1 Temporal trends of the effort on the steering wheel (torque-blue) and on the pedal (brakes black) during the 7th turn (A) and the 8th turn (B) conducted with devices F7 (upper panels) and without (lower panels) . The symbols in red indicate the start and end of the round itself.

MUSCLE ACTIVATION

Figure 2 shows the muscle activation values (RMS) for two significant muscles with reference to the dynamic traces of the 7th turn in figure 1, i.e. the left soleus muscle (SOL_sn) and the left hand flexor muscle (FLE_sn) and for a time lapse of 60 s after the start of the lap. As you can see, the tracks, while showing a high similarity (in fact, the maneuvers are always the same with the relative rhythms) also present differences in the peaks and in the complexity of cumulative activation.

Figure 3 shows the traces of muscle activation for the same muscles considered in the 8th lap and in the corresponding conditions (with and without F7 devices). In this case, the differences related to the diversified maneuvers shown in the dynamic's layouts are evident.

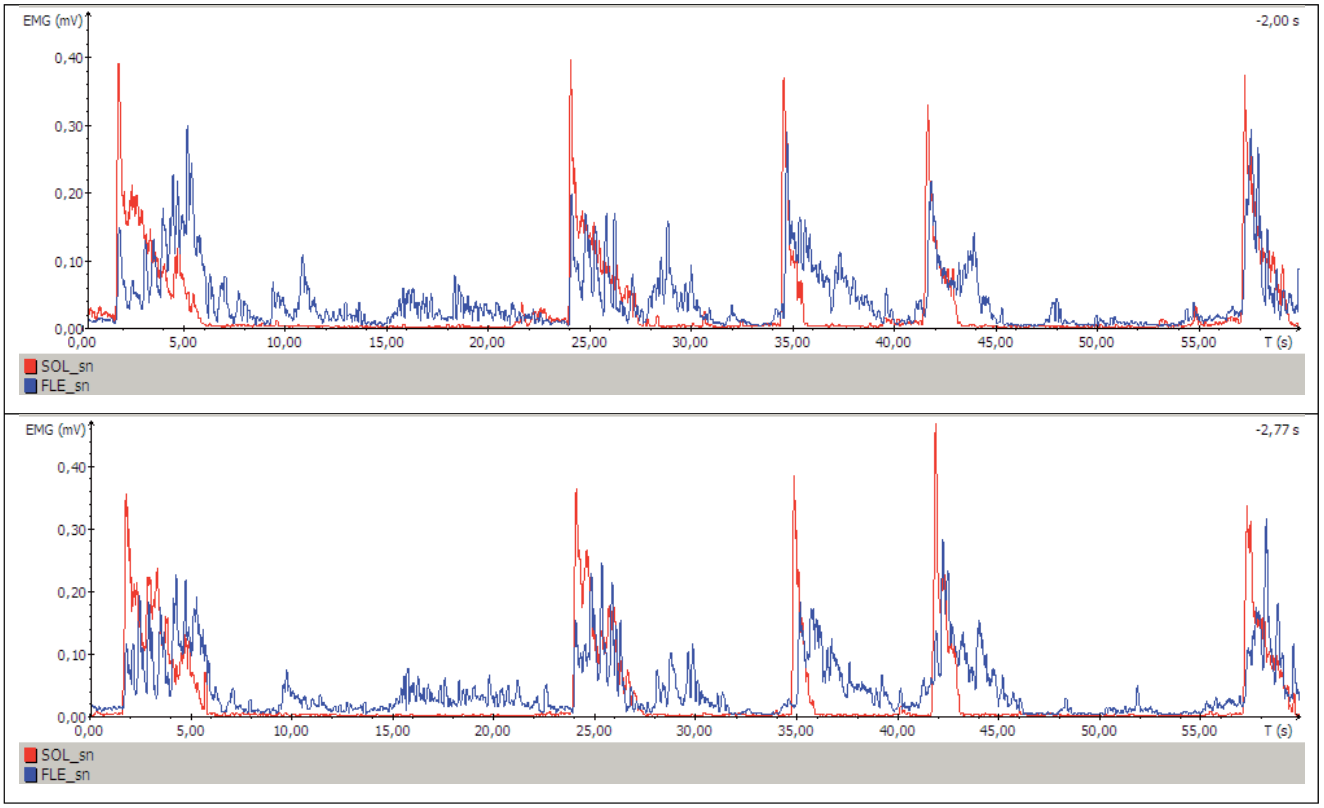
In order to better understand these differences, the integrated activations (i.e., the area subtended by the RMS curves) have been calculated which indicate the total activation quantity (IEMG) of a muscle in a defined period of time (in this case the time dedicated to the same maneuvers found in the telemetry traces). The IEMG rating is considered for the 1st, 7th and 8th rounds.

As can be seen in figures 4 and 5, the activation of the SOL dx muscle and of the TRA sn is less in the 1st lap both in the first 30s and in the overall lapse of the 55s considered. This can be an indicator of "muscle economy" being the best time with the F7 devices.

In the 7th lap the relations are inverted and for the SOL sn (brake) a lower integrated activation is observed for both time frames considered. Again, the total performance is better with the devices

In the 8th turn the activation of the soleus and the left flexor are higher in the presence of the F7 devices, but, despite the head-tail at about 30 s, the total time is still less than about 17 s. The greater activation is therefore explained by a high recruitment capacity despite this being the last lap, therefore with evident symptoms of fatigue.

The graphs at the bottom right summarize what is briefly explained, giving a vision of global activation of all the muscles considered as a function of the number of turns (1, 7 and 8).



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(SOL) which are responsible for the effort on the steering wheel (torque) and on the pedal (brakes) during the 7th lap conducted with the F7 devices (upper graph) and without (lower graph).

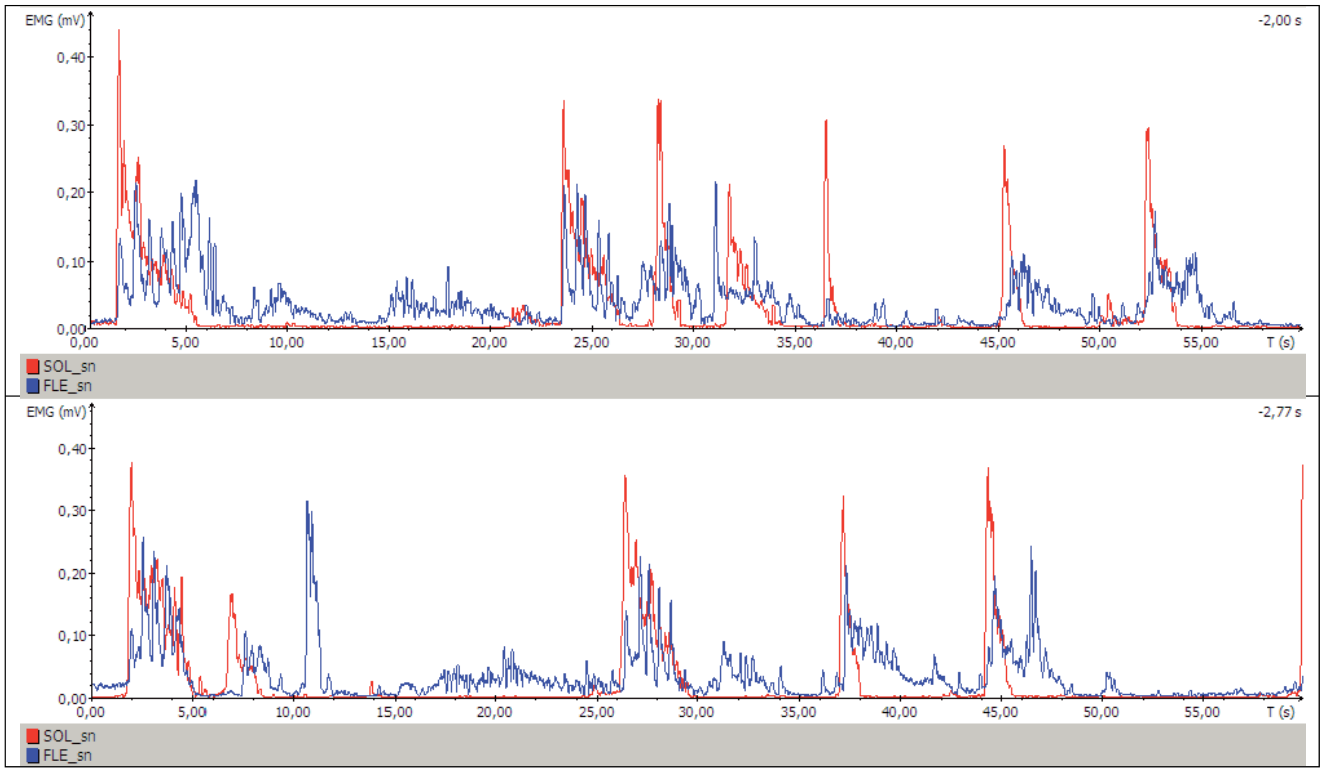


Fig. 3 Temporal trends of the muscle activation of the flexor muscles of the fingers (FLE) and soleus (SOL) which are responsible for the effort on the steering wheel (torque) and on the pedal (brakes) during the 8th lap conducted with the F7 devices (upper graph) and without (lower graph).

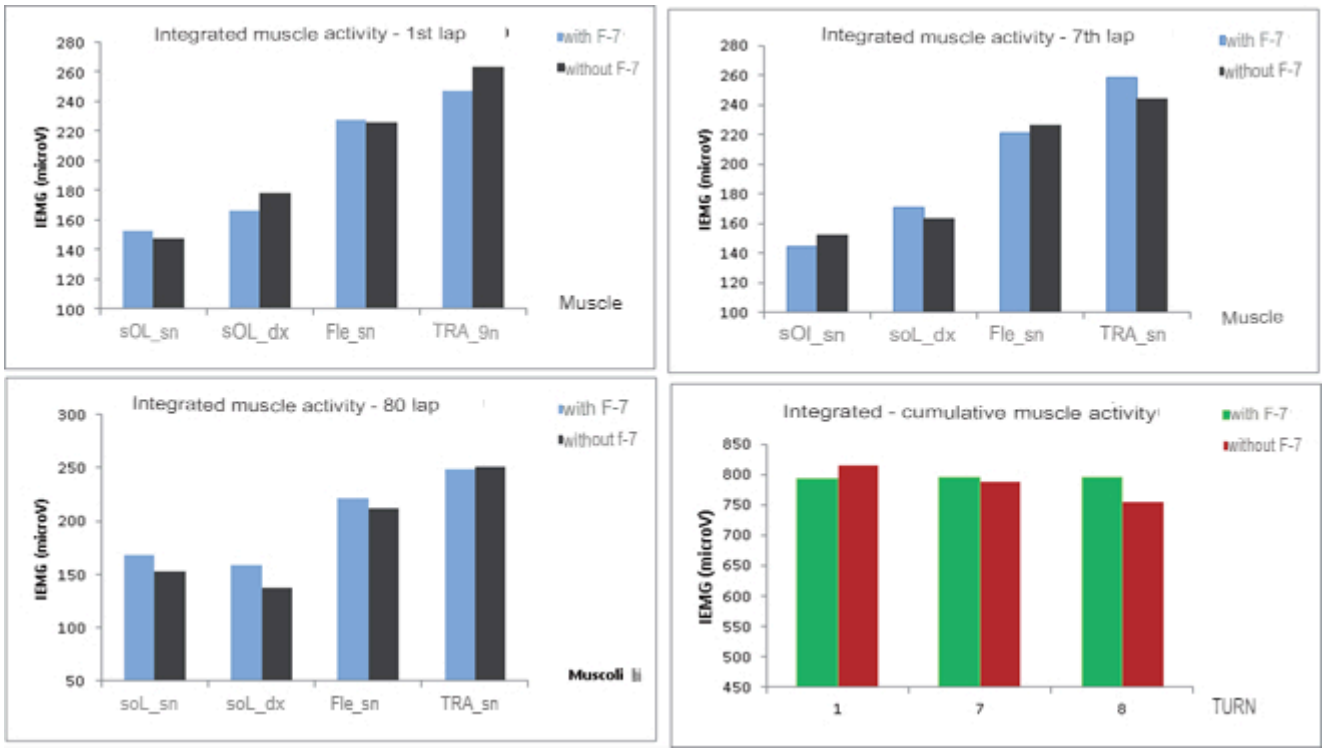


*Fig. 4 Values of the integrated activation (IEMG) of the single muscles calculated on the first **55 s** during some significant turns. In the graph on the bottom right, the cumulative muscle activation is calculated by summing the values of the individual muscles in the respective tests considered. The colors distinguish the presence (with F7) or the absence (without-F7) of the devices.*

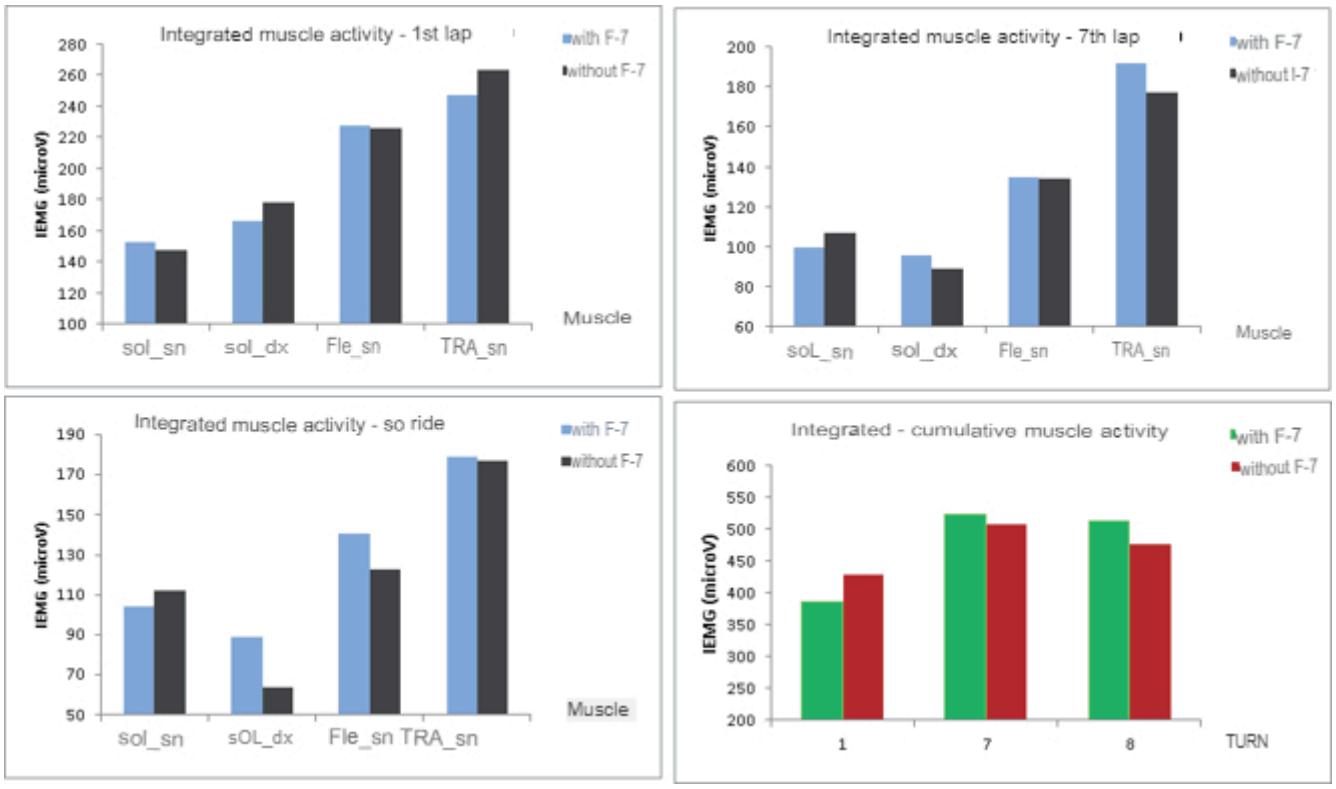


*Fig. 5. Values of the integrated activation (IEMG) of the single muscles calculated on the first **30 s** during some significant turns. In the graph on the bottom right, the cumulative muscle activation is calculated by summing the values of the individual muscles in the respective tests considered. The colors distinguish the presence (with F7) or the absence (without-F7) of the devices.*

Conclusions:

The purpose of this study was to verify any effects of the F7 devices on the performance response of the neuromuscular system of an athlete engaged in repeated tests on the formula 1 simulator. The first element of judgment is represented by the number of errors made (head-tail, excessive braking, straight), with the same number of revolutions (8), in both conditions, with and without the F7 devices. In the presence of the devices, the number of errors is significantly lower in the test with the devices:

- 1st test without F7: 9 head-tail, 1 straight
- 2nd test with F7: 1 head-tail; 1 light straight
- 3rd test without F7: 6 head-tail; 1 straight

The dynamic actions exerted on the steering wheel (torque) and on the brake (brakes) show greater effectiveness in the presence of the devices. This is evident in the different intensity and impulse values of the torque and brakes curves. In this regard, it should be noted that, in travel time, the increase in the values of these parameters in the presence of the devices coincides with a significantly shorter travel time, or that, with the same travel time, the pulses are less.

Similar considerations apply to muscle activation (IEMG) where it is highlighted that, with the devices, in some muscles that are specific to steering and braking maneuvers (the soleus and flexor muscles of the fingers) activation is less for the same time. mileage, i.e. it increases when, at the onset of fatigue (8th lap), further muscle recruitment is required in order to obtain the improvement of reactions and precision in the motor maneuvers necessary to improve walking time.

In summary, based on the data thus acquired and with the limitations of this pilot study concerning a single subject, it can be stated that the F7 devices are able to optimize muscle activation in terms of improved efficiency and also of optimal recruitment. the onset of performance worsening linked to fatigue and psycho-physical stress.

Written by
Dr. Renzo Pozzo



CONCLUSIONS ON THE EFFECTS OF APPLICATION

F-7

IN ERGONOMIC AND DYNAMIC AREAS

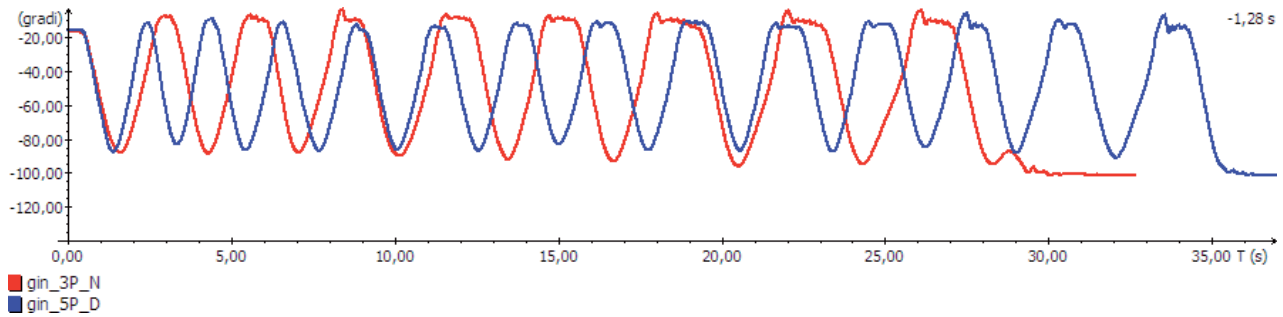
STRETCHING EXERCISES WITH THE LEGS

In dynamic fatigue activation exercises of the lower limbs, a weight on the feet was repeatedly moved by extending and bending the legs on a horizontal press until exhaustion. The F7 devices were inserted in the shoes without the knowledge of the subject who repeated the exercise after 10-minute breaks in order to restore the starting conditions for each exercise.

It has been shown that:

- The F7 devices have significant effects on the activation of voluntary skeletal muscles when intense and prolonged efforts are required.
- Since the subject did not know when the devices were present, a possible placebo effect can be excluded.
- The decreased activation of the musculature associated with the increased number of repetitions obtained with the use of the F7 device indicates an increase in the efficiency of the activation of the voluntary muscles up to 20-25%
- The subjective responses to the feeling of fatigue (local and central) support the experimental data. In this case, the onset of fatigue has improved by up to 38%.

1st test without D	2nd test with D	3rd test without D	5th test with D
7	**11**	**8**	**13**



EXERCISE OF REPEATED ASCENT OF STAIRS WITH OVERLOAD

The effects of the application of the F-7 devices, in the form of strips to be applied inside the shoe in direct contact with the sole of the foot, were evaluated in static posture tests in standing position and in climbing tests on stairs with additional overloads.

It has been shown that in the presence of the F-7 devices:

- The impulses of vertical force useful for the vertical displacement of the center of gravity increase and balance each other. The overall external yield on the shift of the body center of gravity is therefore improved by up to 15-20%.

- The distribution of the general pressure center is wider and better distributed on the support surface, thus favoring the economy of the gesture. This implies a different constellation of biomechanical loading conditions.

- Since the ratios of intensity and direction of the resulting external force change, the internal biomechanical load, that is, the effort that the joints and their muscles must bear to overcome the global external resistance, is optimized.

- The possible cushioning mechanisms (recovery of elastic energy) of the central support phase of the foot are also favored.

EXERCISE OF STATIC PROTRACTED POSTURE

In the presence of the same devices, in the form of breech strips, the behavior of maintaining static balance in an upright position for 30s and with closed eyes was evaluated. This is to make the automatic motor control mechanisms deriving from the information of the proprioceptors of the breech plant even more sensitive. It is evident that this experimental situation tries to reproduce the classic operating conditions of some man-machine environments.

It has been shown that in the presence of the F-7 devices:

- In the event of an evident imbalance in the weight distribution on the left and right supports (DX = 55.0%, SX = 45.0%), with the devices this disappears and the distribution becomes balanced (51.0% on the right and 49 , 0% on the SX).

- The oscillations of the center of pressure on the sole of the foot are reduced in size (about 22%) and in their speed (about 32%). This coincides with a greater index of postural stability and less expenditure of the relative motor control mechanisms.

Dr. Renzo Pozzo-adjunct professor CdL Sports Sciences University of Udine

LACTATE PILOT STUDY

Cycle ergometer test results summary:

Athlete

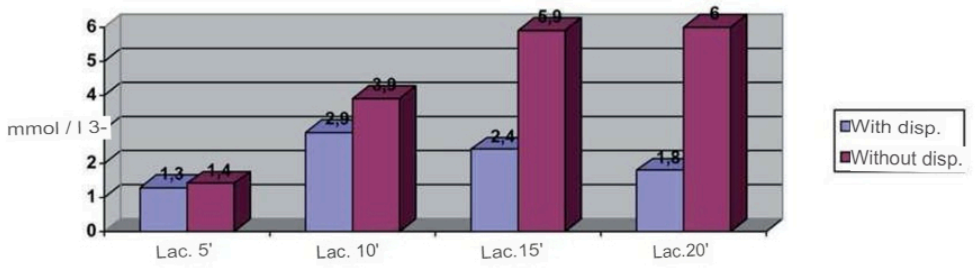
Age 22

Amateur cyclist-device used: D - 7 "classic"

Test protocol:

20 ' of operation in stead state state at a power of 90% of the estimated max Used ratio 50x18 to one pedaling frequency of 86 rpm corresponding on the cyclomulino Porter at a constant power of 300. Monitoring of power and rpm values via soft K Ant+ compatible heart rate monitor and Garmin 800 monitor, blood lactate by withdrawal capillary at 5'-10'-15' -20 ' of operation via laktate Pro arkra analyzer.

After complete recovery of the test (calculation of Half-Life of equal blood lactate values a 30') is provided for the repetition of the test and the same monitoring illustrated above.



At the end of the two Tests the athlete's sensations were of less burning of legs and greater balance D/ / sx Using the Borg scale 6-20 the score was 10 without device and variable from 12 to 8 during the exercise with device.

For content compliance

Dr. Renzo Pozzo

BRIEF REPORT ON THE TESTS OF ASCENT WITH OVERLOAD WITH AND WITHOUT THE USE OF TECHNOLOGY F7 D-7 in the Form of Insoles (called Talus F7)

Report-1

Place: *Body Evidence Center (Conegliano)* ***Date:*** *19 July 2014* ***Now:*** *12:00 pm*

Test: Static stabilometry and fatigue stress tests.

Test carried out by: *Dr. Renzo Pozzo*

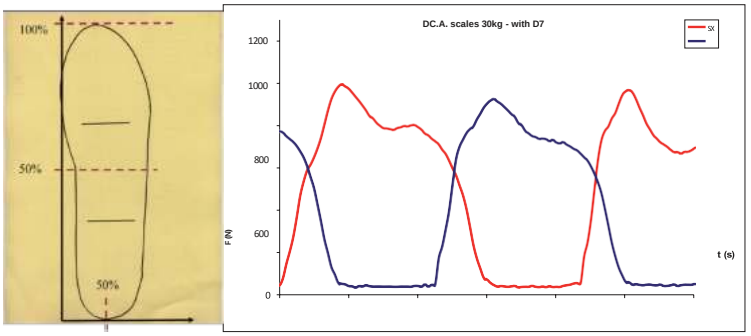
The possible effects of the application were evaluated in the following tests of Talus F7 insoles to be applied inside the shoe in direct contact with the sole of the foot, in relation to the static posture in an upright position and in reference to repeated effort tests to induce generalized fatigue (repeated climbing of stairs with overload).

Instrumentation used

In order to highlight the possible variations of the mode of production of the resulting force of contact with the ground and of its point of application (COP), the Pedar-X system of the novel- GmbH company (Munich) was used which allows to detect the distribution of the pressure on the sole of the foot and to calculate the strength. The system uses 99 capacitive sensors distributed unitarily on a shape in the shape of a shoe sole which, in fact, can be inserted inside the shoe itself. The signal thus detectable was acquired with a frequency of 100 Hz, therefore with a time definition of 0.01 s.



Pedar-X system



Left: reference system for the representation of the COP on the right foot. Right: example of the temporal trend of the resulting forces on the relative feet during an ascent on the stairs.

Parallel to said instrumentation, a video camera operating at 50 Hz was also used for the qualitative and temporal control of motor execution and for any subsequent kinematic evaluations.

3 subjects of different constitution and different motor curriculum took part in the experiment. The results referring to the two subjects most similar to each other in terms of constitution and motor curriculum are reported below.

Dynamic tests

Subject: DC. A .. mass: 81 kg, height: 185 cm, age: 23 in. Gym activity

Protocol: 4 continuous ascents and descents with a load of 30 kg (2x 15) balanced on the shoulders (special bags) and kept in place by the lateralized grip of the upper limbs.

Steps analyzed: last 8 steps at the top of the 4th climb. In fig. 1 shows the temporal trends of the force curves of the respective feet. The curves in blue represent the test with the help of Talus F7 insoles, vice versa those in red. It is noted that, slightly in the left foot, but significantly in the right foot, there is a difference in the peak of force produced and consequently in the corresponding force impulse (the area subtended by the curve with respect to time). In the presence of Talus F7 insoles the peak is reduced.

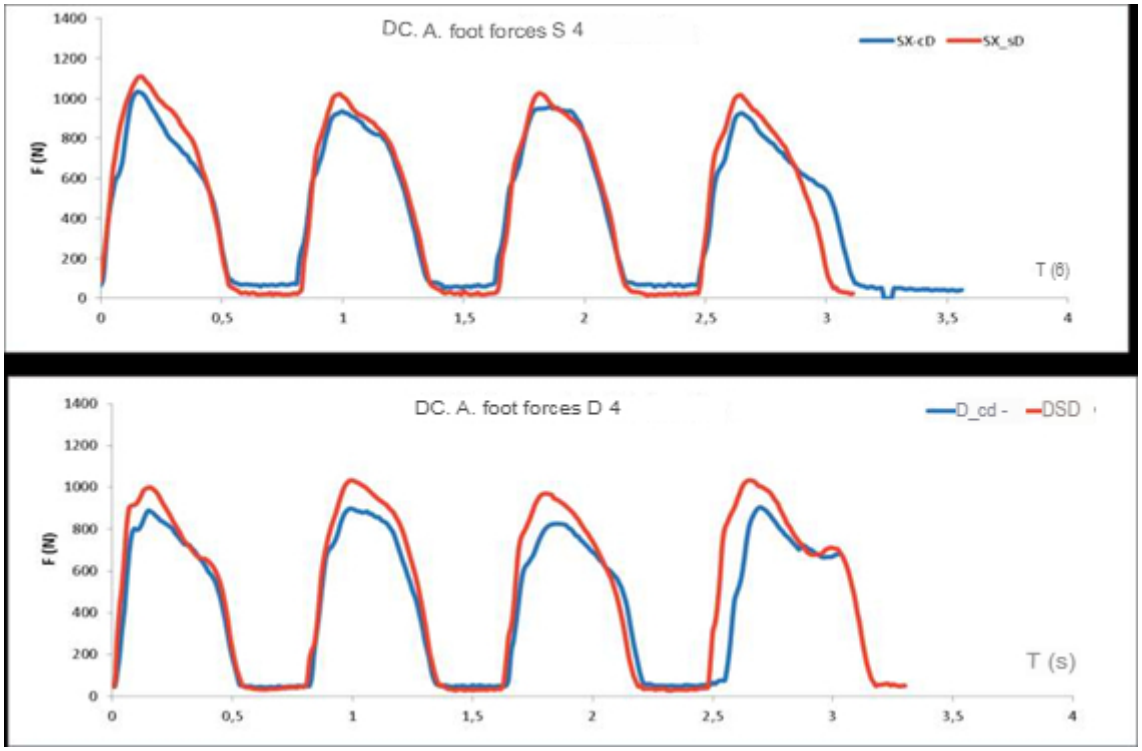


Fig. 1. Timing trends, synchronized at the start, of the resulting forces on the sole of the foot for the 4th climb with use of Talus F7 insoles (curves in blue) and without (curves in red).

In the graphs of fig. 2 shows the displacements of the resulting center of pressure (COP) for each foot and in the different conditions (with and without insolesTalus F7) considered for the respective first two supports shown in fig. 1. As can be seen, in the right foot and in the presenceby Talus F7, the COP path is wider and more similar to the corresponding path detectable on the left foot.

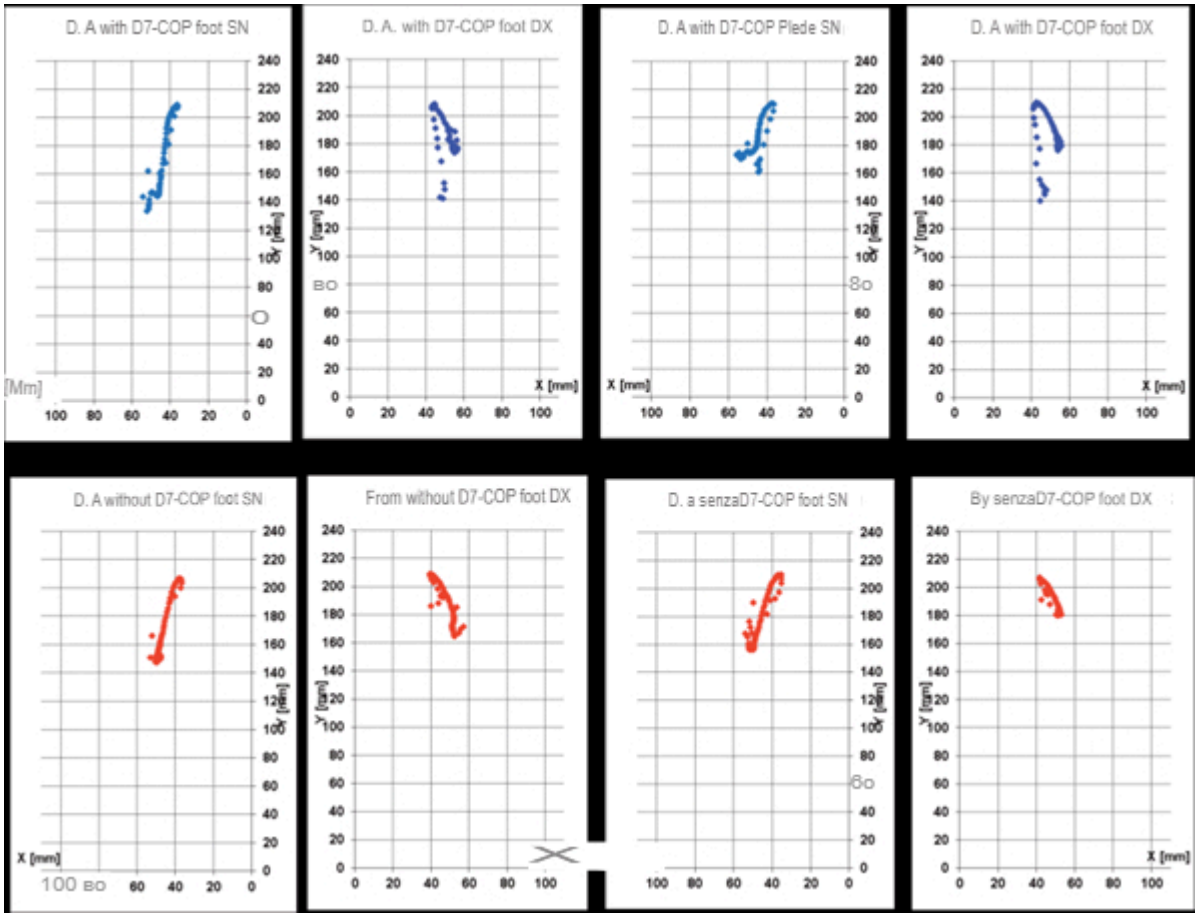


Fig. 2. Spatial development of the resulting center of pressure (COP)

Subject: BD mass: 78 kg, height: 178 cm, age: 42 in. Activities of former athlete. Presents a generalized weakening on the left lower limb as a result of after-effects from surgery.

Protocol: 4 continuous ascents and descents with a load of 30 kg (2x 15) balanced on the shoulders (special bags). 4 climbs were made only with useof Talus F7 insoles, while without this device the subject completed the test at the descent of the 3rd ascent, thus failing to complete the last nominal ascent.

Steps analyzed: last 8 steps at the top of the 3rd climb. In fig. 3 there is a tendential increase in force peaks when they are present the Talus F7 insoles. This manifests itself significantly especially for the second spike on the left foot. The considerable differentials between the maximum peaks and the reduction in strength in the intermediate phase of the curve reveal a walking modulation with a high use of cushioning mechanisms, and possible use of "elastic" energy intrinsic to the dynamic stretching-shortening process of the skeletal muscle. It should also be noted that high values (compared to body weight) at the beginning of the contact phase reflect possible conditions of excessive load for the joint and ligament structures and / or the onset of generalized fatigue phenomena which, therefore, induce the subject to wanting to accentuate the initial "loading" of the extensor muscle chain of the corresponding limb.

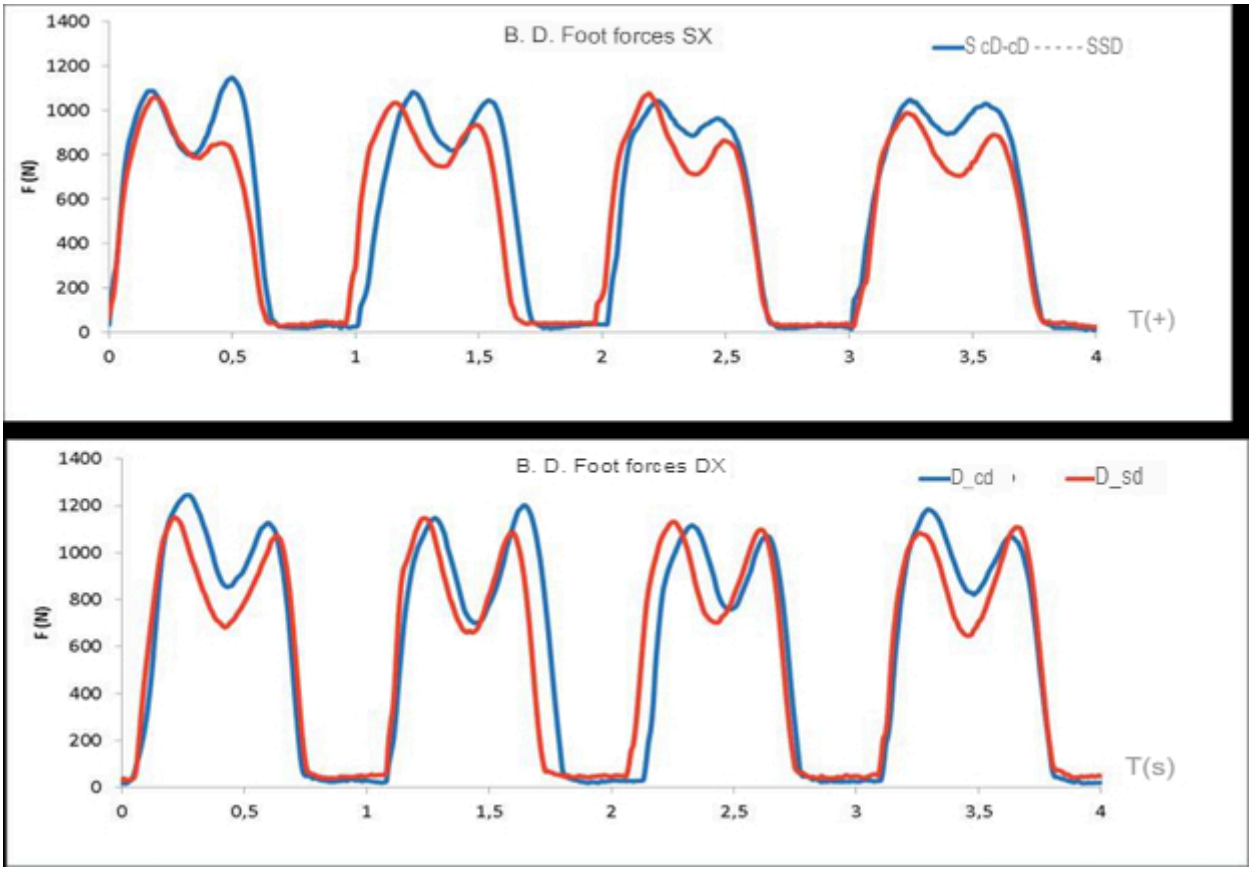


Fig. 3. Timing trends, synchronized at the start, of the resulting forces on the sole of the foot for the 4th climb with the use of devices D-7 (curves in blue) and without (curves in red).

In the graphs of the displacement of the COP it is noted that, without the use of the Talus F7 insoles, the space covered by the COP of the right foot is more posterior than that of the left foot, while in the presence of the devices, this difference is minimized.

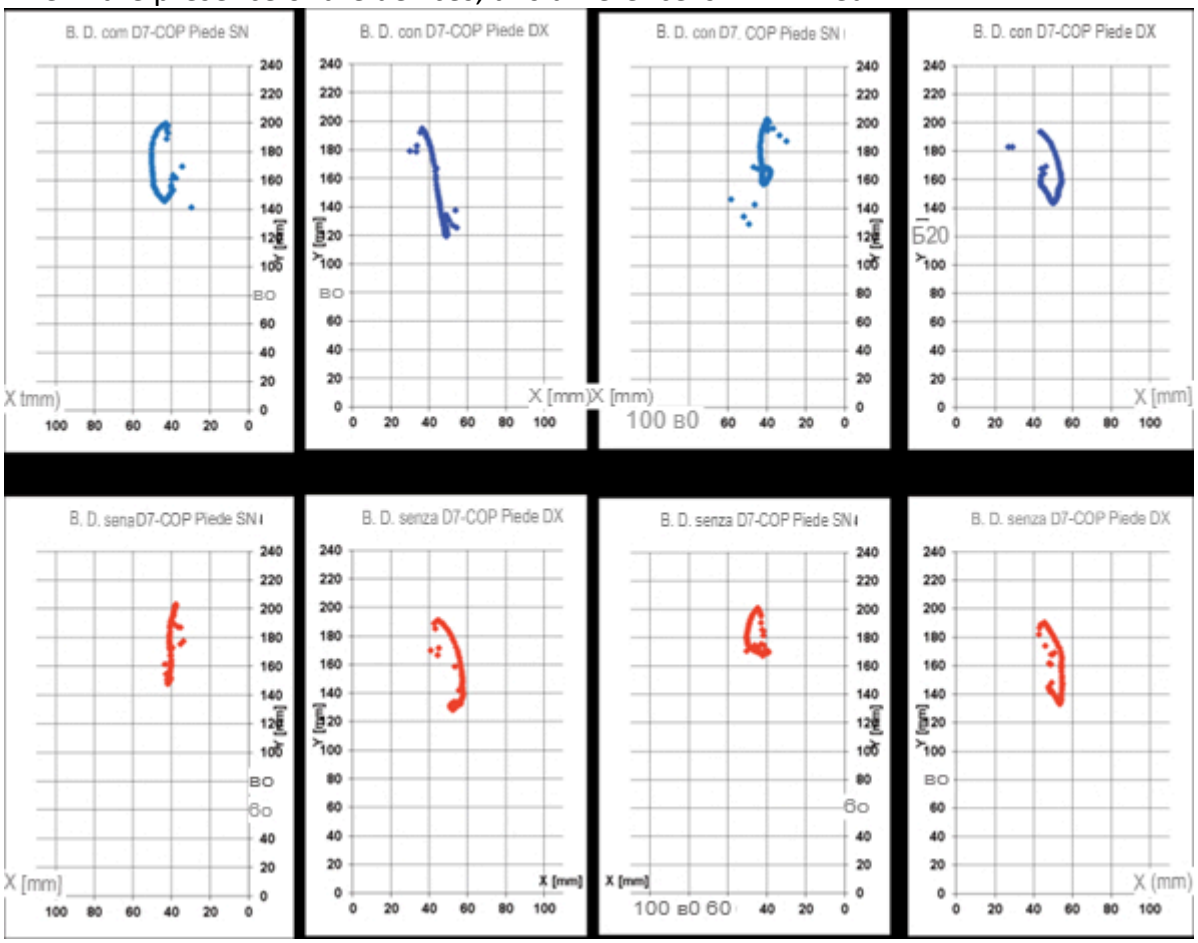


Fig. 4. Spatial development of the resulting center of pressure (COP)

Stabilometry tests

Protocol: the subject had to remain in perfect orthostatic balance for 30 s while keeping the eyes closed. The feet were placed on the ground at an angle of 30 ° between their longitudinal axes (positioning according to the common post urological assessment procedure). Also in this case the tests were conducted with and without the aid of the D-7 devices.

Subject: DC. A .. mass: 81 kg, height: 185 cm, age: 23 in. Gym activity

Analyses: as shown in fig. 5, without, the Talus F7 insoles, the body weight is distributed more on the right support (DX = 53.5%, SX = 46.5%) and the positioning of the COP is asymmetrical, in fact in the right foot it is more anterior than the left. When they come instead use Talus F7 insoles the weight distribution on the supports becomes similar (51.0% on the right and 49.0% on the left) and the COP is equally more symmetrical. It is also noted that the oscillations of the forces become greater in the absence of the Talus F7 insoles and this implies a greater speed of oscillation, especially in the antero-posterior direction. This aspect will be specifically analyzed in a second analysis.

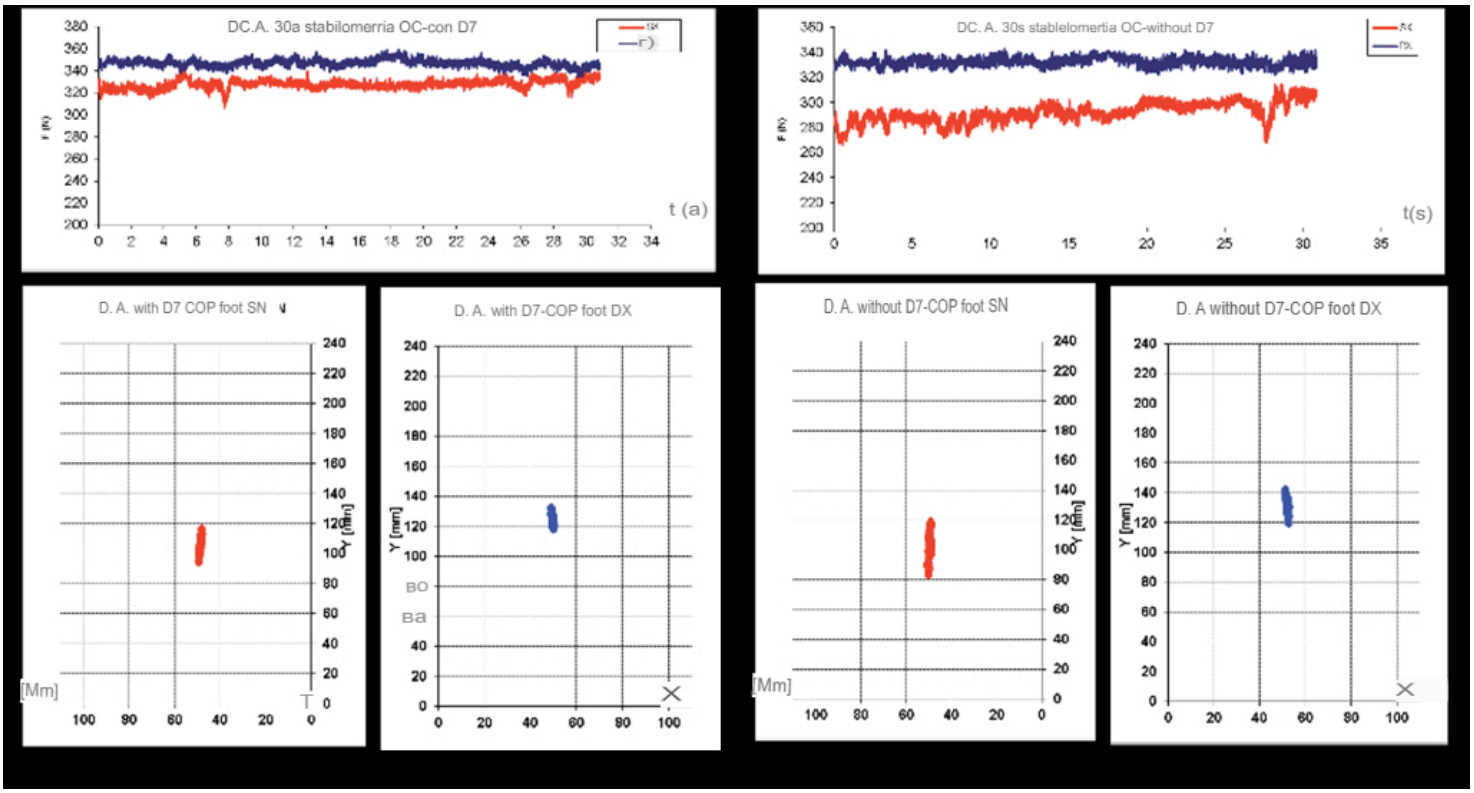


Fig. 5. Subject DC.A. Above: temporal trend of the forces on the feet (blue = right, red = left) in the 30 s orthostatic posture tests with Talus F7 insoles (left graphs) and without (right graphs). Below: spatial development on the sole of the feet of the resulting center of pressure (COP) for the respective force plots.

Subject: BD mass: 78 kg, height: 178 cm, age: 42 in.

Analyses: as shown in fig. 6, without insoles Talus F7 devices D-7 the weight is distributed more on the left foot (SX = 53.5%, DX = 46.5%). In attendance of the Talus F7 insoles of D-7 this difference practically disappears. Also in the dislocation of the COP there is a posteriorizing of the same in the right foot in the absence of the Talus F7 insoles of device D-7. Also in this subject we note that, in the absence of the Talus F7 insoles of devices, the oscillations of the forces are greater.

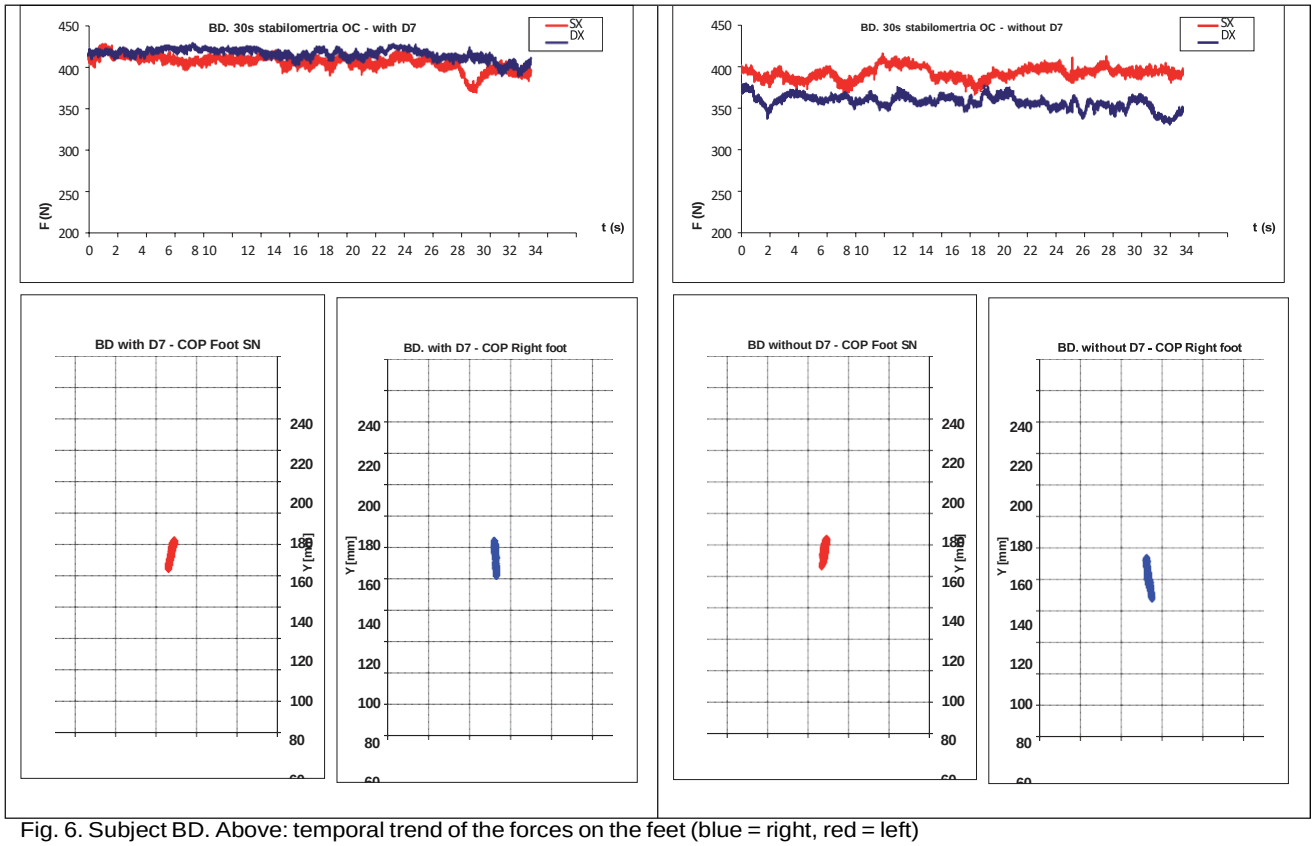


Fig. 6. Subject BD. Above: temporal trend of the forces on the feet (blue = right, red = left) in the 30 s orthostatic posture testswith Talus F7 insoles with D-7 devices (left graphs) and without (right graphs). Below: spatial development on the sole of the feet of the resulting center of pressure (COP) for the respective force plots.

Further analyzes are needed on the same data and on the kinematic ones in order to clarify the qualitative difference of the diversified adaptations found for the two subjects.

Date: *19 July 2014* *Dr. Renzo Pozzo*



PROVISONAL REPORT ON THE RIFLE TEST

Athlete: Dalila

Introduction and experimental methodology

In Olympic rifle shooting, one of the main objectives is to establish which parameters are most influential, or in any case, most correlated with performance. From this point of view and, considering the principles of motor-postural regulation, it is certainly interesting to be able to analyze the parameters connected to postural regulation during the main phases of the technical gesture. The effect is known from some recent studies and further clinical experiences of F7 technology (silicone / rubber) *of devices named F-7®* on aspects of postural and motor regulation in general. Based on this and, in response to the specific request of the coach, we wanted to investigate whether or not these devices can influence the behavior of advanced athletes during the technical gesture. An experiment was thus conceived in which objective parameters useful for the analysis of the aspects exposed can be detected.
To this end, the use of baropodometry associated with the automatic detection of the movements of the competition equipment can represent a specific approach. The systems used consist of a device for detecting the movements of the barrel and the front sight (infrared IR sensors) connected to a software for graphic and numerical processing in real time.

A system for detecting the distribution of unit pressures exerted on the plantar surfaces of the feet (Pedar, novel GmbH Munich) operating at 100 Hz. This system provides the distribution of the breech pressures, the areas, the resulting force and its point of application (pressure centroid, or COP) in each foot.

Starting from these assumptions, we wanted to analyze the behavior of high-level athletes during a training session. Two highly qualified athletes took part in the experiment, consisting in carrying out 40 pitches divided into 4 blocks of 10 pitches each. Before each block, the devices in question were applied to the subject according to the "double blind" method, in which both the subject and the experimenter cannot know when and what are the real and false devices.

In the following the results refer to the athlete Dalila who, after the analysis, presented the following experimental sequence of devices.

Block_1 = no true device; block_2 = F7 devices on the muscle groups of the deltoids and back; block_3 = devices added also on breech plants; block_4 = only devices on breech plants. So the first block session was the one without any external influencers.

Infrared system ratings

The system (infrared sensor, IR) for detecting the movements of the barrel and the front sight is connected to a software that provides different parameters in the time domain and in the space domain with respect to the target (fig.1.1.)

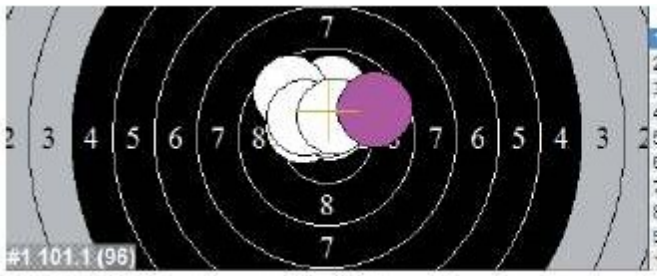
Of these parameters the essential ones are:

POINTS: that is the actual score detected

TIME: the actual time recorded from entering the target up to one second after the start of the shot. Large deviations can indicate various technical deficiencies.

LONG: length of the movement in millimeters during the 1 second time frame before the shot starts. This parameter represents the shooter's stability index. The lower the value, the greater the stability relative to the last moments of the technical gesture.

NN: distance in millimeters of the center of gravity of the track with respect to the theoretical center of the shot. The smaller the value, the higher the precision. A value equal to zero means the perfect coincidence between the firing position and the target position of the shot.



#	Punti	Tempo	10.0	10.5	10a0	10a5	mm/sec	
1	9.6	6.2	65%	9%	93%	48%	12.4	3.2
2	9.9	5.9	56%	7%	100%	51%	14.6	1.8
3	10.6	6.3	70%	41%	99%	52%	13.7	0.9
4	10.3	5.9	81%	19%	100%	70%	13.9	0.2
5	10.5	5.6	72%	39%	84%	46%	14.0	0.2
6	9.9	5.3	55%	0%	100%	73%	12.2	1.2
7	9.6	6.3	49%	1%	99%	83%	12.5	1.6
8	10.3	4.7	81%	11%	100%	87%	10.4	0.9
9	10.4	7.6	35%	2%	100%	72%	15.0	1.9
10	10.0	7.4	93%	8%	100%	88%	13.2	0.8
96	**101.1**	**6.0**	**65%**	**13%**	**97%**	**67%**	**13.2**	**1.3**

Fig. 1.1. Example of output of the IR system associated with the barrel and front sight

The parameters thus defined were first analyzed in their temporal distribution on all the tests (fig. 1.2). As it can be seen that the Time and Points parameters show a differentiated variability from each other in the individual blocks. For the Time the variability is high in the 2nd and 4th blocks, while for the Points it is distributed more uniformly among all the blocks and therefore represents a characteristic perhaps implicit in the discipline and / or the athlete. However, it should be noted that the average of the puti remains in any case within a limited range of variability, ie from a minimum of 10.06 in the 4th block to a maximum of 10.18 in the 2nd and 3rd blocks.

Since the two parameters Lungo and NN represent, the first, the relative stability and, the second, the correspondence between aim and shot, the smaller they are, the greater the combination between stability capacity and control "precision". motion of the click movement on the trigger.

From fig. 1.2 (lower panel) it can be observed that in the 3rd block the two parameters Lungo and NN are almost in one-to-one correspondence, while in the 1st block their behavior is almost opposite.

However, a high standard deviation is noted, especially for the NN parameter.

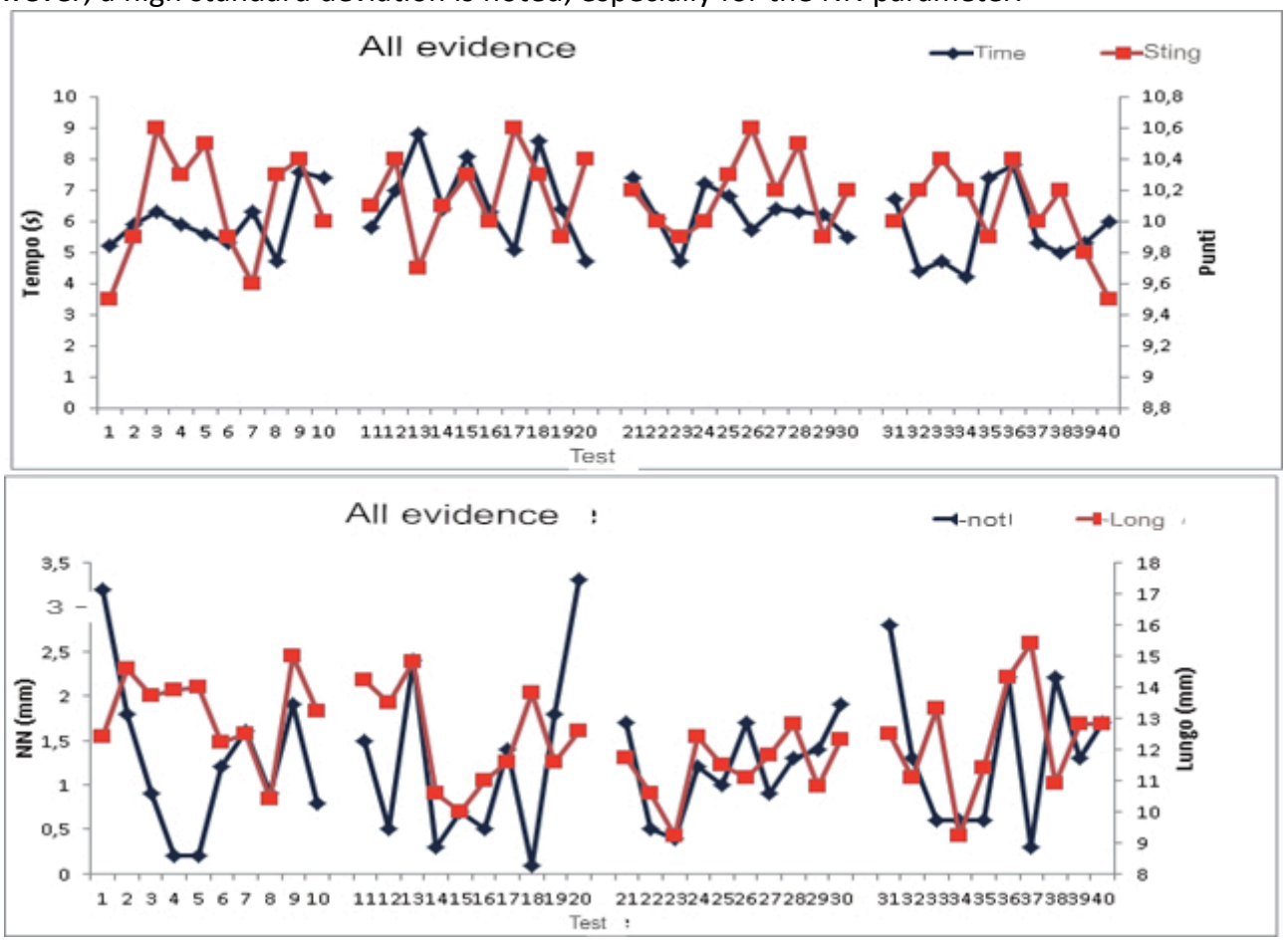


Fig. 1.2. Sequential trends of the parameters Tempo, Points, NN and Lungo in relation to the absolute succession of shots made in the 4 blocks (1-10, 11-20, 21-30, 31-40)

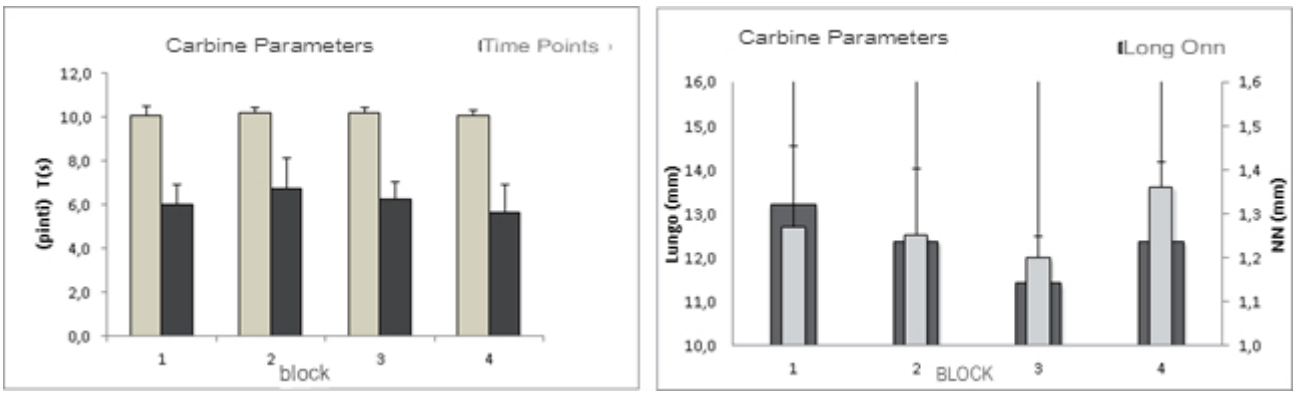


Fig. 1.3. Averages of the main parameters obtained from the IR system divided into the various experimental blocks.

In order to obtain further evaluation criteria on the parameters considered, a correlation analysis was carried out between the variation of the score and the respective variations of the parameters considered. In fig. 1.4 the relations divided into the execution blocks are represented. It is noted that, in the 1st block, as the score increases, the value of NN decreases correspondingly, therefore in line with the principles of the executive

technique. The Lungo parameter, on the other hand, shows a trend with little variation and, in any case, with average high values (13-15 mm).

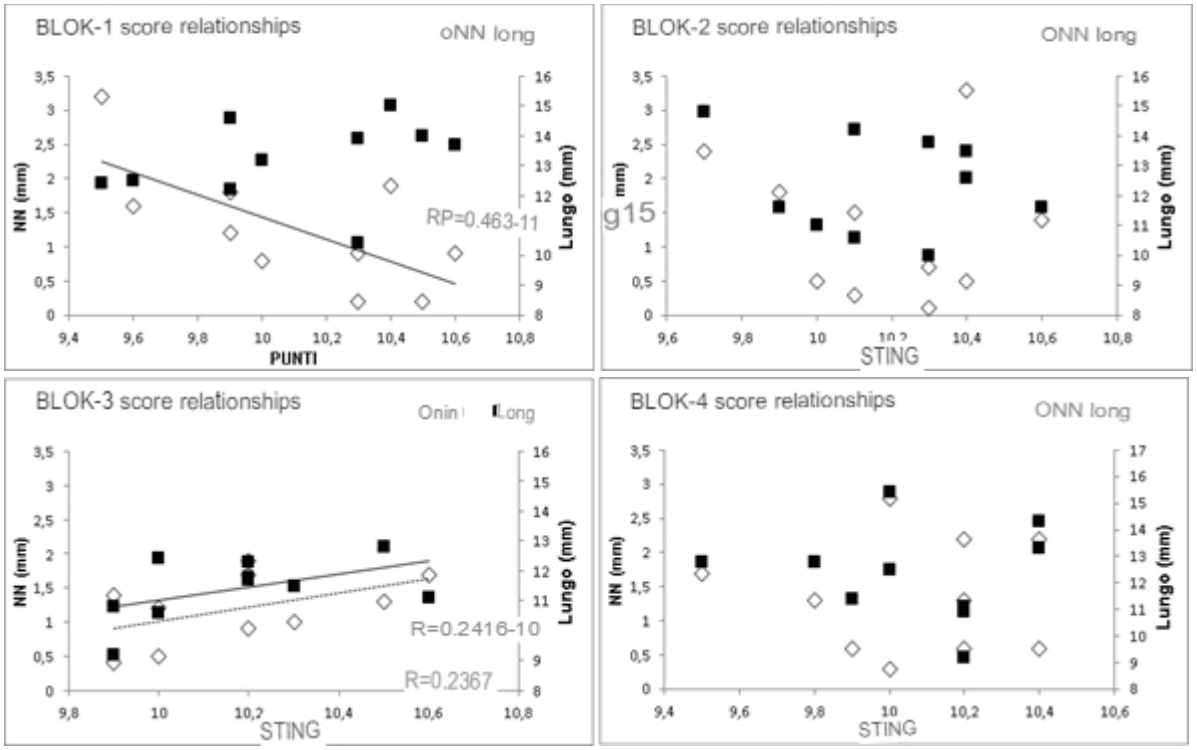
In the 2nd block the trend is similar to both parameters, that is, when the score increases, they show a similar decrease, even if a statistical significance cannot be established.

In the 3rd block there is a linear relationship between the parameters considered with good statistical significance. The fact that both regression lines are positive, that is, that the higher score also corresponds to higher values of the two parameters (Long and NN), could here seem a contradiction with the technical indications mentioned above. However, the variations presented by both parameters are placed in a range (interval of variation) which is the smallest among all the experimental blocks.

With this we simply want to underline that, in the 3rd block, the interrelation between the parameters Lungo and NN is the most concordant and significant.
If, for example, in the 2nd block the values of NN at scores 10.4 and 10.6 were not so high (3.3 and 1.4), but on 0.4-0.5 then the relationship would be statistically very significant and agrees with the concept of shooting precision. However, the variation of the Long parameter would remain diversified, presenting the same an alternation of values between 11 mm and 14 mm.

In the 4th block, if the 3 highest values of both parameters are excluded, the relationships become linearly significant and in accordance with the technical concept (the more stability and precision, the higher the score). Therefore it seems that blocks 3 ^ and 4 ^ represent a more “synergistic” strategy between the two parameters Lungo and NN

Fig. 1.4. Correlation functions between the score and the Lungo and NN parameters in the 4 blocks considered. The straight lines represent a statistically sufficient correlation ($R.^2$ is the index of significance)



Center of Pressure

The position of the center of pressure (COP) on the respective breech areas of support represents the point of application (unloading) of the resultant of the weight force of the subject and, above all, of the adjustment micro-movements that are implemented by the neuromuscular postural mechanism.

During the phase of contact with the ground, in movements such as walking, this point describes defined and typical trajectories for the movement considered and also for the subject himself (fig. 2.1 left). During the posturography tests in orthostatic station, the trajectory described by the COP can be represented as a ball (fig. 2.1 right), this is close to the recordings detected in the present experiment.

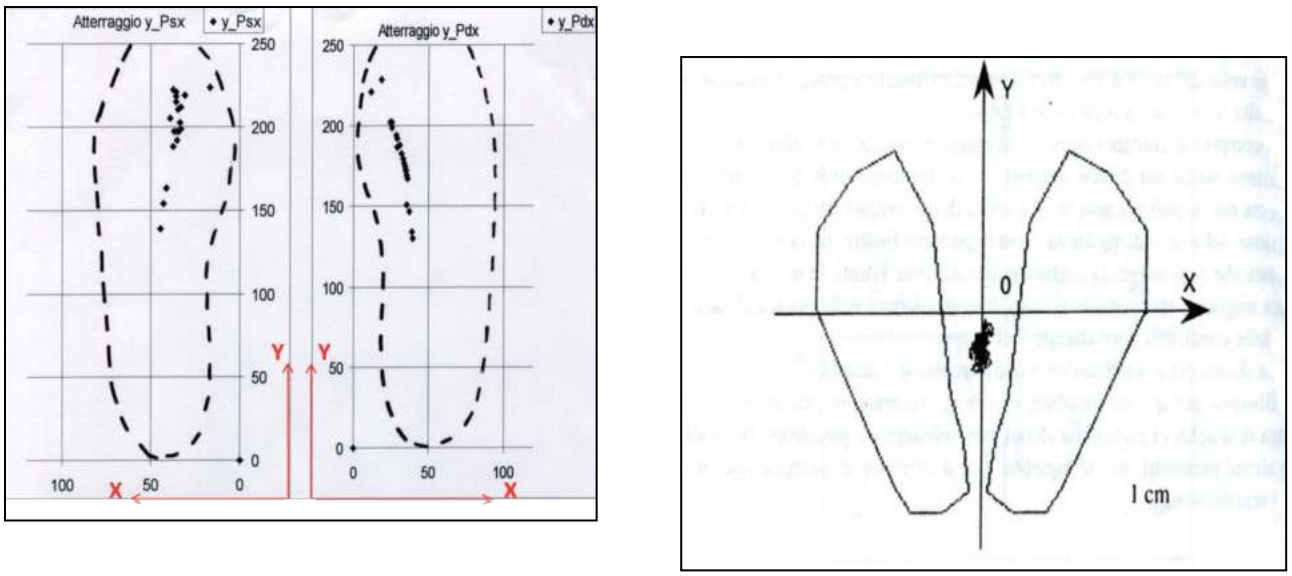


Fig.2.1 Left: example of COP path during the definitions of the X and Y axes for each foot. De orthostatism lasting 52 s. In the case of rifle shooting tests, there are two factors: the short duration of the recording laser pointer appears on the reference monitor ranging between 4 s and 9s (software incorporated in the pointing system), but above all by the athlete's intrinsic ability to maintain a very stable posture as regards his body center of gravity and, consequently, in micro- movements of the respective breech COPs. In fig. 2.2 shows as an example the trajectories described by the COP during a test in which the shooting time is about 6.5 s.

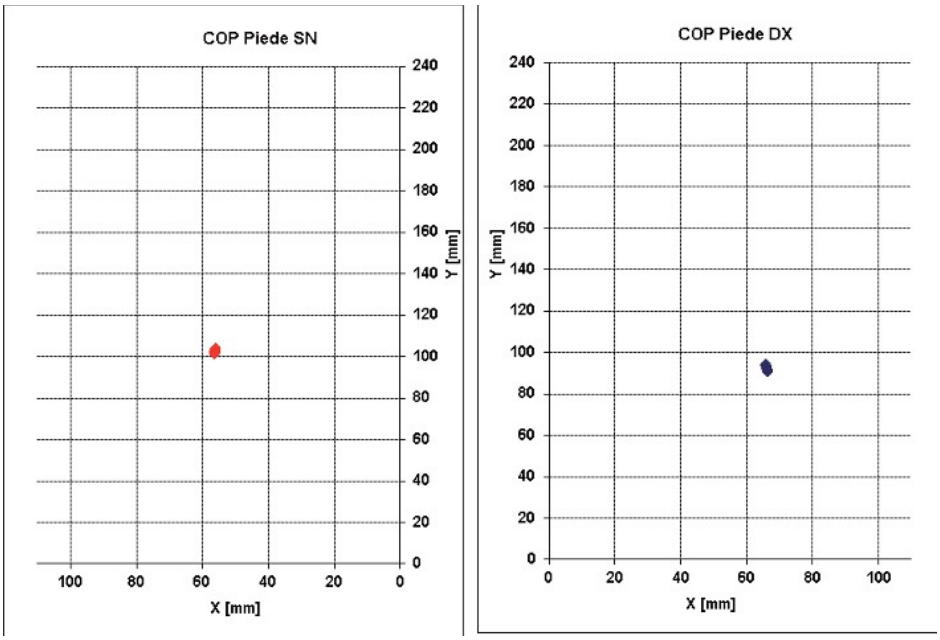


Fig.2.2 Example of the COP course during a shooting test (6.44s pointer travel time)

As previously explained, the athletes performed 40 throws divided into 4 blocks of 10 throws each, in which the external conditions were changed (with or without the device)

The parameters obtained from the COP traces are the following:

- Averages of the X and Y coordinates of the respective COPs
- Maxima and minima of the Y coordinate (i.e. of the antero-posterior displacements)
- Maximum and minimum of the coordinate in X (i.e. of the medium-lateral displacements)
- Range (variation interval) between the maxima and minima of the respective XY coordinates

In fig. 2.3 shows the average values the standard deviations of the X and Y coordinates calculated for the entire recording period of the test (from the entry on the target until about 1 second after the shot) for each foot (upper panel) and also the differences between the minimums and maximums of the same coordinates (lower panel), again in relation to the 4 experimental blocks. It is noted that, with the progress of the tests (of the blocks), the Y coordinate of both feet, but especially that of the right foot tends to increase (from 88.6 mm to 99.9 mm), that is, the athlete tends to move the COP forward on the sole of the foot.

On the other hand, in blocks 3 ^ and 4 ^, the X coordinate assumes lower values than in the previous blocks (about 61 mm against 66 mm), ie the COP is moved towards medially on the breech plant.

The range between the maximums and minimums of each coordinate represents the maximum differential of the COP along the coordinate considered. It is found that, for the Y coordinate, this range of maximum variability is from 3.7 mm to 4.1 mm for the left foot, while, for the right foot, it varies from 4.2 mm to 6.3 mm.

While for the coordinate the difference in the values of the Y range in the single blocks may lead to suppose some post urological significance, for the X coordinate, the small variation supports the hypothesis of identity.

For the X coordinate, the range never exceeds 1.5 mm, therefore it can be considered constant in all blocks, as found in the corresponding average values.

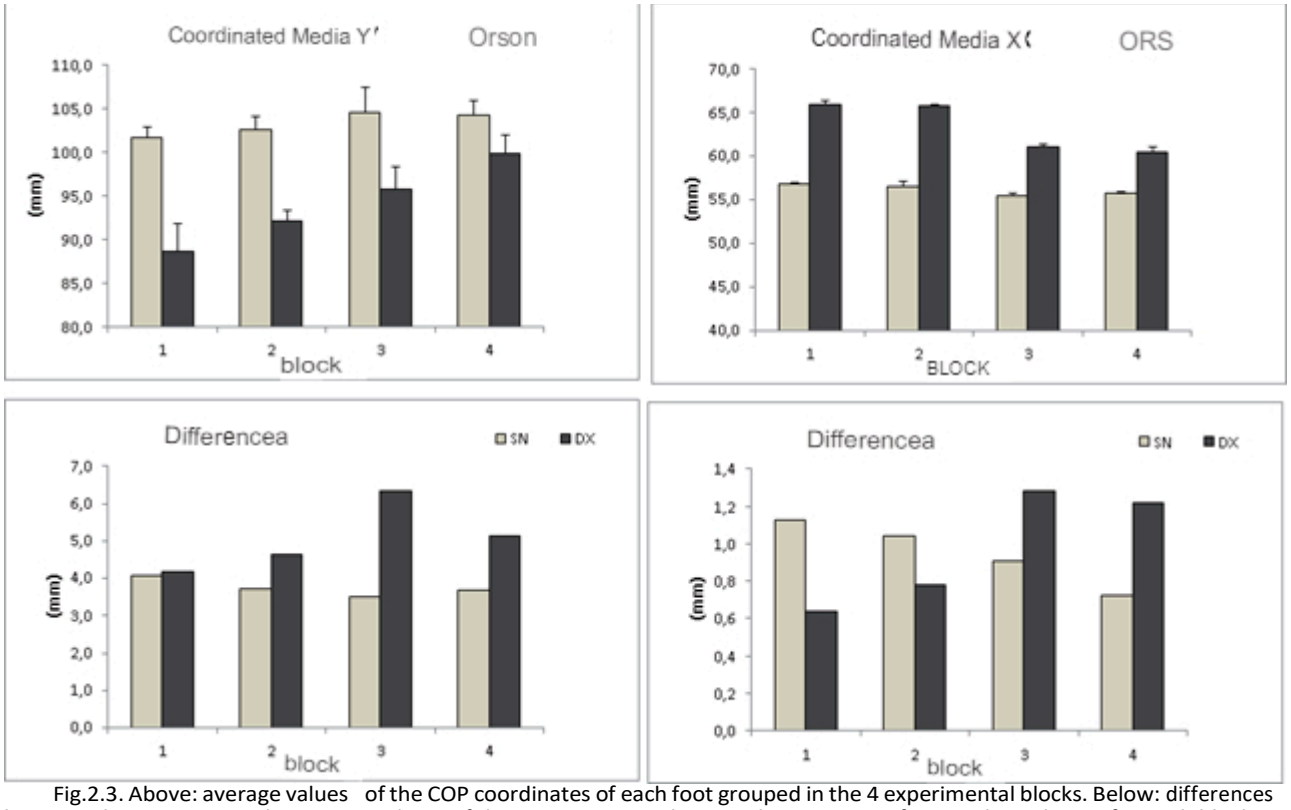


Fig.2.3. Above: average values of the COP coordinates of each foot grouped in the 4 experimental blocks. Below: differences between the maximum and minimum values of the respective coordinates. The averages refer to 5 shots chosen for each block.

From the above data on the variations of the COP it can be deduced that the athlete in question has an excellent body stability, however there seems to be a modulation of the position of the COP especially on the right foot as a function of the block to which he belongs. In fact, blocks 3 and 4 differ substantially from the previous ones.

At the end of this analysis, the external experimental conditions were disclosed, i.e. how the F7® devices were applied, in this case:

- Block 1: real devices applied on the trunk
- Block 2: no real device
- Block 3: real devices on the trunk and breech plants
- Block 4: devices true only on breech plants

On the basis of the above, the following hypotheses can be deduced:

- The 3rd block is the most efficient given the score and the minimum values of the parameters Lungo and NN. Moreover, it was in this block that the athlete was subjected to the maximum use of the F7® devices.
- The 2nd block also shows a good level of effectiveness if we consider that the score is equal to that of the 3rd block and that the values of Lungo and NN are the most "similar" compared to the 3rd block. Only the trunk devices were present in this block.
- It seems that the devices intervene more on the characteristics of the COP of the right foot and this occur mainly in blocks 3 ^ and 4
- For a clarification on the strategy of administering the devices, i.e., whether they are to be applied in both body sectors considered or if one of the two is sufficient, further tests are necessary to guarantee the repeatability of the results.

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