hunova for performance optimization of the football player: a case study

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We would like to present in this case report how we have carried out an experimental assessment and training protocol with hunova for the evaluation and the optimization of physical performance of the players of "Genoa Cricket and Football Club (CFC)" youth team, an Italian football team which plays in Serie A. We decided to evaluate the athletes using a specific assessment program with an innovative robotic device to analyze balance components, reactivity to perturbations, lower limbs strength, ankle range of motion (ROM) and core stability with numerical parameters in order to find the players with worse performance in one or more functional areas compared to the rest of the team. In this case report we present the data of one of the football players who resulted impaired in 2 functional areas compared to his teammates. After a focused training on hunova the subject's performance returned equal to the one of the rest of the team players. The improvements we observed encouraged us to share this experience: in response to the robotic training program core stability and ankle range of motion improved in a significant way.

Introduction

The most important variables for measuring performance in team sports such as football are physical condition and technical skills. The aim of this experience was to evaluate physical conditions in young football players using a multidimensional standardized test battery denominated Performance Index. All the tests performed are run on an innovative robotic device called "hunova". The Performance Index is a multidimensional evaluation index used to analyze the total body physical condition of the subject performing the test and compare the overall performance with respect to normality ranges, consisting of the mean values of the entire team. This index is a performance evaluation that covers different functional areas and gives an indication of where the subject is in deficit (compared to the teammates) and where the athlete needs to work to maximize physical performance and hopefully prevent injuries. The Index is calculated as a combination of the results of the assessments grouped into 6 functional areas: *Core, Bipodalic Equilibrium,*

Monopodalic equilibrium, Ankle Strength, Ankle Range of Motion (ROM), Monopodalic Reactive Balance. Performance Index was developed with the goal of having a simple and fast tool to evaluate physical performance, identify weak functional areas and focus training on them. The overall performance, decomposed in the previous functional areas, is represented in the form of a 6-point radar graph as shown in Figure 1. For each area (point of the graph) a colored dot is represented which represents how the subject positions himself with respect to normality (inside normality ranges or not: grey lines) in each functional category. If the dot is green, the performance in that area is excellent and does not require specific training; if yellow the performance is good, if red is fair, if black is poor. For these last 3 colors hunova recommends a specific training different in difficulty depending on performance level. In this case report we present data collected from a 20 years old football player at the beginning and at the end of the sport season.

Athlete

Male, 19 years old, professional youth league U-19 football player playing as a central midfielder in Genoa CFC since 2017. At the time of our evaluations (September 2018 – April 2019) the subject was not injured and was recruited in all the matches of the team.

Initial evaluation

Evaluation in form of Performance Index was performed at recruitment (T0 – September 2018, beginning of the football season) and at the end of the training period (T1 – April 2019, end of the season) after a 6-month interval. The assessment required 30 minutes and consisted of the following robotic tests on hunova:

BIPODALIC STANCE
1. Balance test on static base
2. Balance test on elastic base (dynamic)
3. Squat assessment

SITTING
4. Five times sit to stand
5. Balance test on raised static seat
6. Balance test on raised elastic seat (dynamic)
7. Balance on proprioceptive seat and combined passive base
8. Balance on proprioceptive seat and variable counter resistive base

MONOPODALIC STANCE
9. Balance test on static base (right foot)
10. Balance test on static base (left foot)
11. Reactive balance (right foot)
12. Reactive balance (left foot)

ANKLE (Right and Left)
13. Ankle ROM sagittal plane
14. Ankle ROM frontal plane
15. Isometric test (-10°; pushing in plantar flexion)
16. Isokinetic test (150°/s, flexion and extension)
17. Isokinetic test (90°/s, flexion and extension)
18. Isokinetic test (60°/s, flexion and extension)

The results of the initial assessment (T0) are reported in Figure 1 in a radar plot representing the functional areas scores that make up the performance index. Each area has a score in the form of a colored dot.
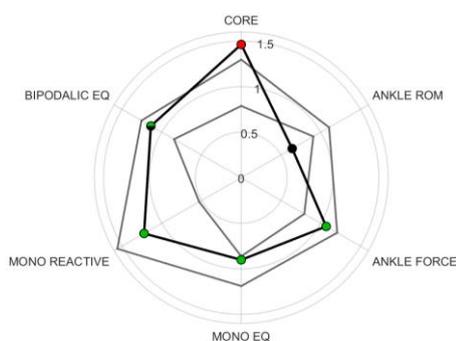

Figure 1: Performance Index at T0, initial assessment. Core and Ankle range of motion resulted out of range (between the two grey lines) and need a specific training.

The grey lines delimit the area of the graphic within which the data will assume the green color (normality of the team). A red dot means that the score is out of range

within a certain amount in the specific functional area. Black means that the value is very far from the normality range. The athlete's core and bilateral ankle range of motion functional categories scores emerged outside the normality range calculated evaluating the performance of all the team members; ankle ROM is very limited in respect to the values scored by the teammates. In Figure 2, each functional area is separated in its main components or divided into left and right sides. Four out of six functional areas are green except for core and ankle ROM. In these two areas the athlete resulted impaired in the double platform core tests and in both right and left ankle range of motion.
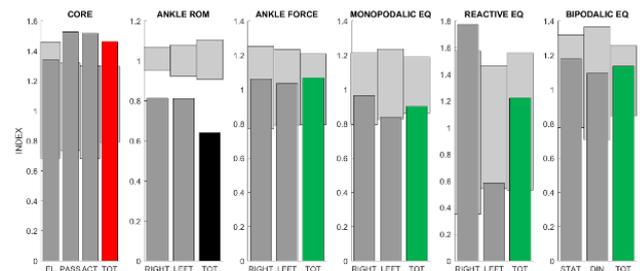

Figure 2: The six functional areas of the Performance Index at T0, initial assessment. Each functional area is separated in its main components or divided into left/right. Core and Ankle ROM resulted out of range globally (colored column), but the grey bars represent which test/laterality was the one with the worst performance.

Training goals

Training was focused on the 2 functional areas which resulted inferior in performance respect to the rest of the team: Core and ankle ROM. Each functional area had a dedicated training macroarea. The combination of the two macroareas created the training session. Ten personalized hunova training sessions with variation of difficulty depending on the athlete's performance were prescribed together with conventional team training on the field and in the gym. The proposed exercises had an increasing progressive difficulty for each training session. Each training session on hunova lasted 1 hour, once a week. Sessions were focused on core strengthening and increasing bilateral ankle ROM.

Results

Following the focused 6 month training the athlete repeated the evaluation test. In Figure 3, the results from the Performance Index at T1 are represented. Core and ankle ROM functional areas improve and are now inside the normality range (green color). The remaining areas are still normal, as expected. The overall performance index score improved from 61% to 76%.
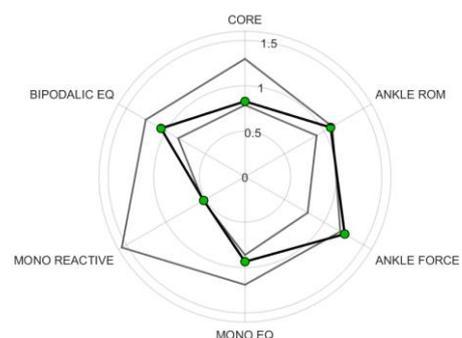

Figure 3: The six functional areas of the Performance Index at T1, final assessment. After the focused training, Core and Ankle range of motion are now back into the normality ranges of the team.

Core functional area bars in Figure 4 are now normal and the global score passed from red to green: core training on hunova was successful. Ankle ROM resulted out of range bilaterally at T0. At T1, the right foot range of motion is equivalent to the mean of the team while the left ankle ROM is even better than the team values i.e. the specific training has increased ankle mobility to values higher that the team ones.
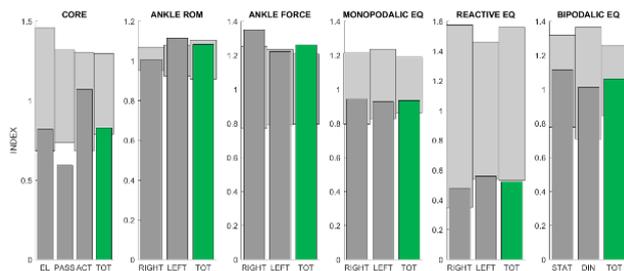

Figure 4: Performance Index bar plots at T1, final assessment. Core and Ankle ROM resulted globally inside the normality range (green bars). In the Balance test on elastic seat with combined passive base, the bar is out of the normality area

Conclusions

hunova is a very powerful device to evaluate performance and optimize it. Our interdisciplinary team has contributed to the development of the performance index method selecting the most valuable hunova assessment tests that could express the athlete's overall performance and grade it. In addition, specific training programs have been created for each athlete of the team depending on which functional areas were considered impaired after the first test. The athlete we present in this case report took the performance index test at the beginning of the sport season. In comparison with the rest of the team, he resulted with minor performance scores in ankle range of motion and core functional areas. During the entire training season, the athlete performed focused sessions on hunova, training on these two areas once a week in addition to traditional training. When the player repeated the test, the performance index was much higher (76%), and all the functional areas resulted into normality ranges. Furthermore, the athlete performed very well during the season, but the most important evidence is that he never got injured.

We believe it's very important to evaluate performance during the season in order control each athlete's physical status compared to the team and prevent injuries. The performance index is an easy and valid instrument to use in all sports for all type of athletes.