

NEW CRITERION FOR “STABILITY OF SIGHT” WHEN SHOOTING WITH A PNEUMATIC GUN ON THE BASIS OF ELECTRONIC SHOOTING TRAINING SYSTEM “SCATT”

Original scientific paper

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Abstract

Stabilometric resistance of the body in this examination has been evaluated through a platform for the examination of equilibrium resistance whose working algorithm is described in Gikova & Tishinov (2013). Simultaneously with the fluctuations of the GCG, the trajectory of sight at shot has been recorded through electronic shooting training system “SCATT”, Russia. Our examination showed a direct link between sagittal hesitations of the GCG and vertical thrill of the sight when shooting “straight” with pneumatic gun. The goal of this examination was to seek and define a new quantitative criterion to assess this relationship. A quantitative criterion has been proposed as well for “stability of sight” on the ground of an analysis of the shooting through electronic shooting training system “SCATT”, Russia. The obtained results are useful in selecting and training of young shooters as well as for the verification and improvement of sports technique of the experienced marksmen.

Keywords: posturology, equilibrium, shooting, GCG

INTRODUCTION

Shooting sport helps physical development and strengthens various muscle groups in growing up children. Like in any sport the main benefits are psychological strengthening of child, sustainability of health and comprehensive physical development.

The training process involves studying the theory, the equipment and basic techniques of shooting. Follow absorption of individual propulsion physical actions and elements forming the basic structure of the shooting technique. Adolescent gradually increased coordination complexity of specific shooting exercises that create the necessary shooting habits. They develop qualities such as speed of response, sense of time, visual memory and static endurance so important for shooting. Looking at this from a psychological point of view, volitional qualities build such as self-discipline, patience and concentration.

When shooting in the position “straight” with pneumatic gun one of the factors to achieve excellence is taking an optimal posture for shooting. This posture is important for achieving maximum stability (immobility of the system shooter – gun) when shooting [Gagey & Weber (1995). The main factors determining the stability of the shooter in position “straight” are: footprint, the highly situated General Center of Gravity (GCG) of the system shooter - gun toward the support area; unnatural diversion of the upper part of body aside and backwards in order to compensate the weight of the weapon, muscle tremor and tensions in targeting arising when fixing kinematical chains. These destabilizing factors occurring simultaneously, lead to vacillation of the weapon and influence the precision of the shot. Disturbed equilibrium function may be the result of various factors (Norre, Forrez & Beckers, (1987), mainly damage in any of the systems regulating the equilibrium.

The term stabilometry (posturography) is a group of methods for the examination of equilibrium resistance (function) of the human in the upright position (Shirov (Широв, (2012); De Wit, (1973); Guidetti, Barbieri, Monzani, Monzani, & Galetti, (1986); Guidetti, (1992); Hirvonen, T., Hirvonen, M., & Aalto, (2002); Jakson, Epstein & De L'Aune, (1995); Jeong, (1994); Kaptein, Bless, Kodde, Massen & Mol, (1983). This means recording and analyzing fluctuations of GCG projection through platform and computer processing of the recorded data (Kazakov, Umanski & Klimenko, (1989).

The purpose of the present examination was to seek and define a

new quantitative criterion for assessment of this relationship.

METHODS

Stabilometric resistance of the body in this examination has been evaluated through a platform for the examination of equilibrium resistance (fig. 1) whose working algorithm is described in Gikova & Tishinov (2013).

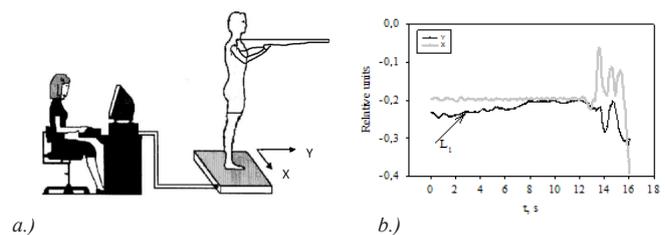


Fig. 1. Platform of stable metric resistance: a.) Block diagram; b.) registered GCG fluctuations in both directions X and Y.

On the output of the platform a recording receives of time fluctuations of the GCG of the shooter in two directions - transversely X and sagittal Y (Fig. 1a.). The shot brings an abrupt change in these two signals (Fig. 1 b.) (Tishinov (ТИШИНОВ 2012).

Simultaneously with the fluctuations of the GCG, the trajectory of sight at shot has been recorded through electronic shooting training system “SCATT”, Russia. This is a universal training simulator program serving to visualize in real-time, reporting and analysis on every shot. This system records in time the trajectory of the sight before, during and just after the shot on vertical plane (Figure 2). The results are displayed both as a trajectory of the sight (Fig. 2 a) and as X (horizontal) and Y (vertical) oscillations of the point describing this trajectory (Fig. 2 b).

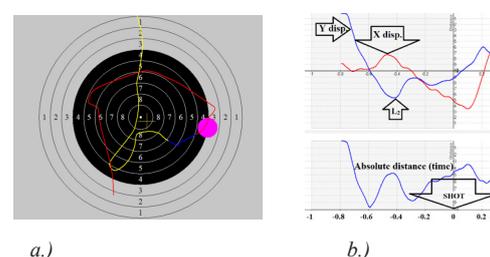
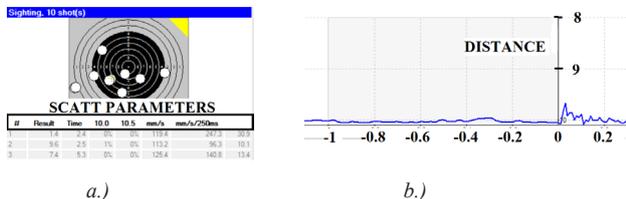


Fig. 2 Data Console of shooting training system “SCATT”

This software system shows after each shot several parameters characterizing the result achieved. These are: 1. The number of the shot; 2. Achieved result; 3. Time of the target; 4. Percentage of presence in the area 10; 5. Percentage of presence in the area 10,5; 6. Speed of the track of sight; 7. Length of the target line; 8. The Distance between the midpoint of the target and the hit (Fig. 3a.).



a.) Fig. 3 A.) Main Menu with results of “SCATT”;
 B.) The actual distance between the track of the sight and the centre of the target as a function of time (absolute distance (time)). The signal is recorded at shooting of an excellent marksman.

RESULTS

An important factor for achieving high performance in shooting sport is the level of technical preparation of the shooter. To carry out such training is needed competent coaching staff that carries it out. Therefore responsibility and competence of the trainer are the most important prerequisites for correct selection, training and success of growing up shooters as well as for verification and improvement of the sporting technique of the experienced marksmen.

Fig. 2b shows two charts calculated by “SCATT” system. One contains information on the horizontal (X disp.) and vertical (Y disp.) displacement of the trace of sight from the center of the target. These are the X and Y fluctuations of sight as a function of time. The second chart shows the actual distance between the trace of sight and the center of the target as a function of time (absolute distance (time)). As the shooter is better, the X and Y fluctuations of the sight are smaller. Hence the course of the line from the second chart (the magnitude of the absolute distance) is closer to the abscissa (the center of the target) (Figure 3 b.).

In coaching practice for the analysis of shooting all described indicators are used, which are derived from the system “SCATT”. The detailed analysis of these parameters characterizing the achieved result showed that another quantitative parameter can be defined and introduced, which to be called “the sustainability of sight” and recorded as ΔS (fig. 4). The measurement unit of ΔS is meter multiplied by second (m.s), and really represents the area under the chart depicting the absolute distance between the track of the sight and center of the target as a function of time (Fig. 2 b. - (Absolute distance (time))). This area is limited in the left and in the right by the lines defining the time interval for which is calculated ΔS.

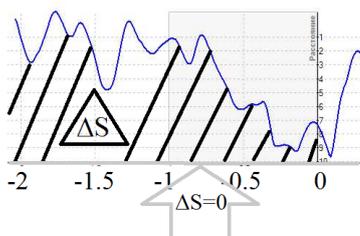


Fig. 4 Definition of quantitative parameter “the sustainability of sight” - ΔS.

The ideal trajectory of aiming (gray line in fig. 4) consists in this the sight to lie always and completely in the center of the target. This means that Figure 4 will constitute a straight line lying on the

abscissa of the chart (gray line). The area below this line will be zero. As greater the fluctuations of sight are, as the line will be situated at a greater distance from the X axis, and hence the area will be correspondingly greater.

The experienced and good marksman has a minimum value of a new introduced parameter ΔS (fig. 3b.). The study of ΔS at different time intervals of aiming and their comparison will allow evaluation of the criterion “sustainability of sight” as the coaching team can trace out the progress of assimilation of shooting technique. With the improvement of technology and performance the value of the parameter ΔS will decrease. The benefits of its registration for different time intervals of targeting, for different postures of shooting, different grip of the weapon, various stages in the preparation of the shooter are expected to be significant.

Simultaneous recording of fluctuations of GCG through equilibrium platform and the trajectory of sight at shots through the system “SCATT” enables the assessment of the relationship between the equilibrium stability of the shooting position and the vacillation of the sight.

The team composed of shooting coaches of SC “Levski” together with teachers from National Sports Academy “Vasil Levski” is developing a new methodology for the selection and preparation of future shooters (children and adolescents) and to verify and improve the experienced marksmen. The results were received for the existence of a direct link between sagittal fluctuations of GCG (Y direction on fig. 1b.) and vertical thrill of sight when shooting “straight” with pneumatic gun (fig. 2b. - Y disp.). On this basis a quantitative criterion can be defined for assessing the link identified. The working hypothesis is consisting in the following: The twice signals – sagittal GCG oscillation and vertical sight fluctuation were visualized on one plot with identical time synchronization (fig. 5). It must be chosen suitable scale for Y axes in order to be achieved uniform scale for the twice signals. The differences between the signals YGCG and Ysight must be find: $\Delta Y_n = Y_{GCG} - Y_{sight}$.

The result ΔYn must be plot as a function of the same moments of time n, at which it was obtained. The size of ΔYn and its change with time is marker for the relation between sagittal GCG oscillation and vertical sight fluctuation. When this difference is negative then the relation is conversely proportional. As this difference is smaller with time the investigate relation is better.

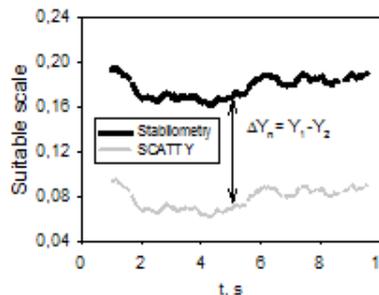


Fig. 5 Relation between sagittal fluctuations of GCG (Y direction on fig. 1b.) and vertical thrill of sight when shooting “straight”.

CONCLUSION

The measurement of the criterion “sustainability of sight” - ΔS at different time intervals of the aiming and their comparison at different conditions will allow the coaching staff to track the progress of assimilation of shooting technique. With the improvement of technology and performance the value of the parameter ΔS will decrease.

Its registering for different time intervals of targeting, for different postures of shooting, for different grip of the weapon, various stages in the preparation of the shooter is expected to be beneficial at the individual choice of the best position for shooting.

The proposed quantitative criterion ΔY_n is forthcoming to be calculated from now on. Its numerical values will show different levels of connection between sagittal fluctuations of GCG and vertical oscillations of sight for any shooter.

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