BIODYNAMIC ANALYSIS OF THE UKI GOSHI TECHNIQUE IN JUDO

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Abstract

Active experiment for analysis of movement activities dinamographic structure of "Uki Goshi", one of the main ku-dan system judo techniques has been performed. The hypothesis that there are much more complicated interrelations between kinematical and dynamical structures has been proved. With the means of reacting dummy, the uke counter attack in the specific points of dynamic function development has been modeled. The untenability of classic biodynamic analysis conclusions, where the uke reaction is not modeled was proved. This study has also relation to the creation of individual training process for highly qualified competitors.

Introduction

It is known that the sport technique is very multidimensional quantity and have different aspects regarding the specific function and applicable sport-technical rules. A set of criteria for quantity evaluation referring to volume, stability, variety and effectiveness of sport-technical actions are developed in the theoretic biomechanics[2,4]. There is a principle difference between sport disciplines with individual and group character. In cases of two persons combat (judo, sambo, wrestling etc.) the classic biomechanics criteria for force impulse, linear acceleration etc., are compromised by the fact, that upon the attacking system exist an uncontrolled external force reactions influence (uke).

As working hypothesis of this study, we accept, that performed so far dynamographic records carry only superficial information about the movement system possibilities. Because of the sophisticated interdependence between kinematical and dynamical structures in the highly changeable external situational field, the adaptation and correction potential possibilities in the process of the execution of the technique remains concealed[1,5].

Method

The main aim of this study is construction of controlled active experiment for quantitative biodynamic evaluation of the compensative possibilities for opponent's force reactions overcoming.

In order to achieve the aim the following purposes had to be resolved:

- Development of specific software for special points evaluation (in real time from the dynamographic curve record achieved from tri-dimensional strain-measurement platform).
- Hardware development of reacting dummy.

The laboratory experiment was held with 10 judo players with sport-technical mastership above 1st dan. The sport technique Uki Goshi was investigated, because it is in the basis of all hip techniques of the ku-dan system.

The laboratory task provided implementation of dynamographic analysis on the support reaction vector of tori at performance with dummy, with consecutive determination of all dynamographic curve specific points[3].

The next set of dynamographic analyses was performed with standard force reaction releasing by the uke in direction opposite to the throw direction. The reaction moment was selected by the random numbers law in the area of the main specific points.

In order to standardise the experiment the same reaction force F=100N was used in all cases.

Results and Discussion

Regardless of individual peculiarities in performance of the technique, because of the kinematical structure similarity of the movement system the dynamographic curves family has the same progress logic.

Summarised expression of the dynamographic record type is presented on the figure 1. Here are presented the main global extremes and multiple local extremes are smoothen as carriers of the information peculiarities.

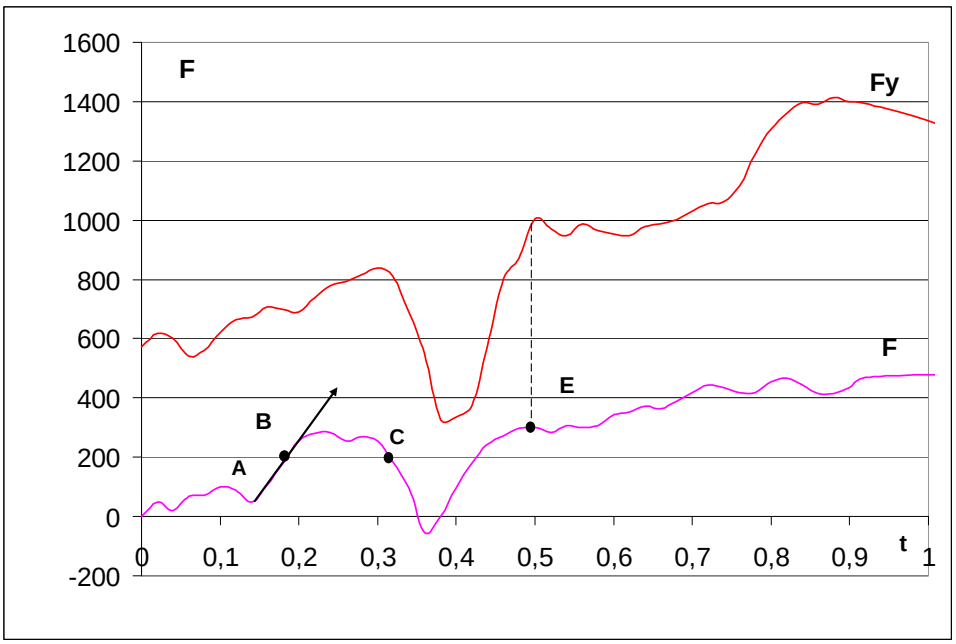

Fig. 1

The classic biodynamic analysis would determined as main critical point D from the curve of the horizontal component, as it would suggest that with smaller effort in this area the attack could be overcome. We deliberately did not perform analysis of the dynamographic curve after E, because after this moment the vertical component became bigger than the combined weight of the tori and uke and it is presumed that there is no contact with mat and the influence of uke on the technique have rather kinematical than dynamic characteristics. In table 1 are presented the results illustrating in statistical scope the experiments with reacting dummy model effect. The deeper structural relations in the whole movement system are obvious. In general scope at all examined persons it appears that biomechanical system have considerable potential for overcoming of the counter attack in the global minimum area. This is valid even to competitor №5 who have "paradox" negative values for the horizontal component of the support reaction force in the global minimum point (D).

Characteristic	A			B			C			D			E		
№	**Fav**	**S**	**V**	**Fav**	**S**	**V**	**Fav**	**S**	**V**	**Fav**	**S**	**V**	**Fav**	**S**	**V**
1	75	42	56	72	24.1	33	48	10.1	21	38	8.2	22	300	42	14
2	96	32	33	78	19.2	25	54	11.8	22	42	6.1	15	360	39	11
3	36	26	72	116	15.3	13	54	12.2	23	57	4.2	7.3	420	58	14
4	124	38	30	88	16.1	18	68	14.1	21	59	3.4	5.8	280	48	17
5	121	39	32	84	21.4	29	82	11	12	72	1.9	2.6	390	21	5

Table 1

Especially important for the analysis is the fact, that application of external to the movement system force is not explained with algebraic subjection. This means that the internal dynamographic structure is far dense than external manifestation and the researcher should not be attempted to analyse such type of dynamographic records.

As long as variation coefficient could be interpreted as system stability, most destroying effect on it have the reactions in extreme points A and C, or this moments are most appropriate for performance of counter actions.

In individual scope the test person №3 obviously have problem in the beginning of the attack and the training process should accent on the first or "kudzushi" phase.

Surprisingly clear are the final phases of the test person №5. Consequent deep analysis of the cause-effect relations between kinematical and dynamical structures ensuring this stability would be of interest. We emphasise again that this competitor at normal, not influenced by the reactions performance, global minimum D has negative value (F (D)=-16.2N).

By the individual peculiarities analysis in the behaviour of the influenced dynamograms became clear that used experimental methodic could be applied with success for modeling and improving of deeper structures of sport-technical mastership.

Conclusion

1. Performed laboratory experiment undisputedly proves the untenability of sport-technical mastership evaluation based on classic (or simple) dynamographic record of the tori force vector.
2. With the means of developed "passive" or "active" experiment simulating uke reactions are determined some general regularities as well as a set of individual ones bearing quantitative information for sport-technical mastership.
3. As most significant conclusion we consider the fact of proving of the cogency of the hypothesis about significant differences in the interpretation and analysis of dinamographic curves recorded in "passive" and "active" experiment conditions. Thus is proved not only the multidimensionality of sport-technical mastership, but also it hierarchic structure in depth. Of course remains open the question about realisation of larger scale experiments for evaluation of interdependence between parameters of the tri-dimensional spatial attack and defense force vectors.

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