KOLMAN AND PEGAN SALTOS ON THE HIGH BAR

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In the last five years Slovenian gymnasts are among the best in the world on the high bar and their inovativeness is already a part of the history of modern artistic gymnastics. Two extraordinary gymnasts showed two very difficult flight elements, which were named after them as they were successfully performed at the most important competitions - world and European championships. The first element was innovated by Alojz Kolman (bronze medal on the high bar at the European Championship in Loussane 1990) who performed a 1 1/2 salto backward tucked with a 111 turn over the bar to the regrasp (Kovacs salto with 1/1 turn). The second element was innovated by Alja' Pegan (European champion in Praque 1994) who performed a 1 1/2 salto forward tucked with a 1/2 turn over the bar to the regrasp (Gaylord I with 112 turn). Both elements are placed among E parts (the most difficult elements) by FIG's Code of points and they have not yet been analysed. Alojz Kolman is 171 cm tall and weights 61 kg. Alja' Pegan is 176 cm tall and weights 70 kg. This is a quite big difference between the gymnasts and the dynamic parameters that will be related to the body weight. Both elements were analysed by the Consport Motion Analysis System. For the definition of the 3D coordinates we used two one meter cubes. We recorded the motion with two SVHS cameras at a frequency of 25 frames per second. The digitization of the chosen points, from the video recorder to the computer was done with genlock, supported with the Consport Motion Analysis Software. For the analysis the following points of the body were chosen: face top and bottom, left and right wrist, elbow, shoulder, foot, ankle, knee and hip, body centre of gravity (BCG), all together 17 points which formed the following 15 body segments: face, left and right forearm, upper arm, instep, calf, thigh, hip, tranversal segments of hips and shoulders. We used the Susanka body model, which is implemented into the CMAS software. For calculation of the various forces we made a special computer program. In both cases we started with the analysis when the body passed from the first quadrant to the second. Both elements were analysed up to the regrasp moment plus 3 frames. We analysed the preparation phase, the release from the bar, the flight and the regrasp.

Kolman and Pegan saltos were developed from the previous elements (Kovacs and Gaylord I). To present similarities and differences we added analysis of the Kovacs salto performed by Csaba Fajkusz (167cm/63kg) and Gaylord salto performed by Elo Robert (176cm/63kg), both are members of the Hungarian national team.

The most important results are (Table 1, Figure 1 and Figure 2):

A. During the preparational phase:
   Kolman and Pegan have a higher velocity,
   Kolman has an extremely extended head (by his words mostly to be able to differentiate kicks for Kovacs and Double Tsukahara for dismount.
   Backward (Kolman and Kovacs) elements require hyper-extended hips and the forward elements (Gaylord I and Pegan) flexed, the absolute difference 180 - hip angle is similar for all four elements.
   Backward elements require knee flexion to kick.

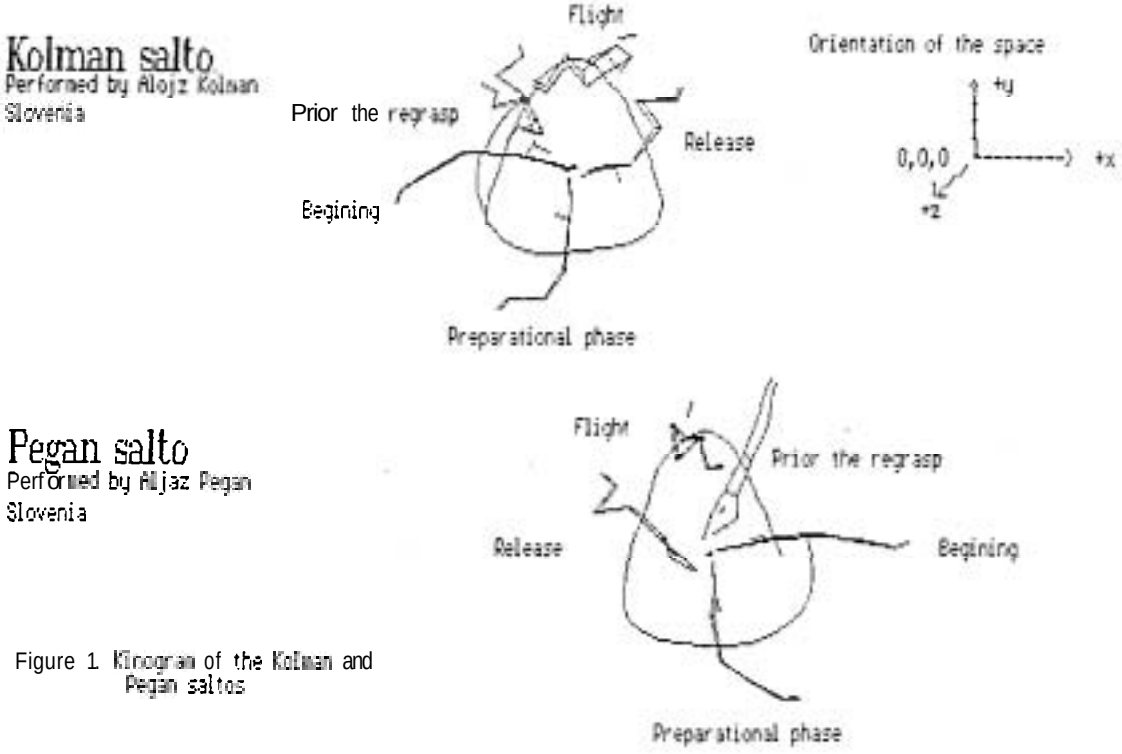

Figure 1 Kinogram of the Kolman and Pegan saltos

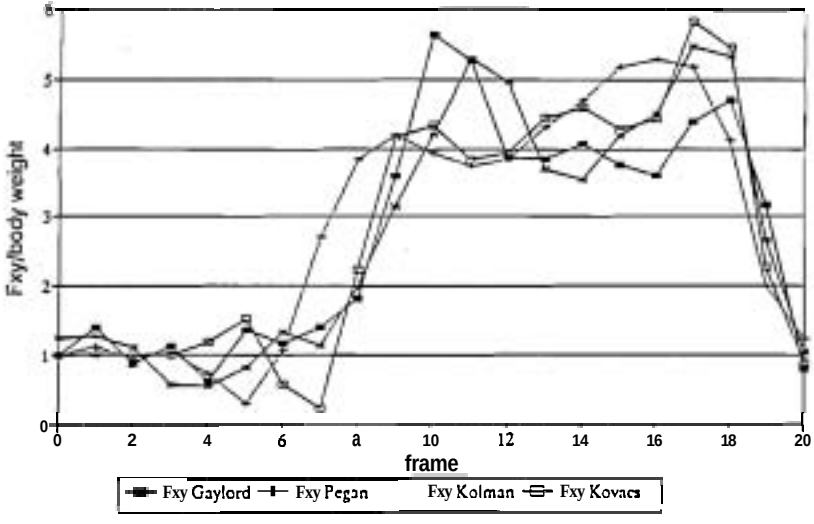

Figure 2. Relative Fxy during the preparational phase

Table 1. Basic kinematic data of the flight elements

		Kovacs	Kolman	Gaylord	Pegan
Prepar.ph.	Vxyz	6.08	6.57	6.40	6.65
Release ph.	Vxyz	4.56	4.60	4.59	5.47
Flight ph.	Vxyz	1.65	1.68	1.60	1.48
Regrasp ph.	Vxyz	5.20	5.17	3.79	3.88
Prepar.ph.	Vx	6.08	6.48	-6.36	-6.64
Release ph.	Vx	-1.90	-1.94	1.99	1.41
Flight ph.	Vx	-1.80	-1.81	1.77	1.37
Regrasp ph.	Vx	-1.89	-1.59	1.74	1.57
Prepar.ph.	Vy	-0.32	-0.07	0.55	-0.64
Release ph.	Vy	4.17	4.17	4.18	5.31
Flight ph.	Vy	0.15	-0.05	-0.19	0.07
Regrasp ph.	Vy	-4.92	-4.91	-3.35	-3.52
Prepar.ph.	Head angle	155.00	256.00	163.00	177.00
Release ph.	Head angle	222.00	233.00	187.00	195.00
Flight ph.	Head angle	173.00	209.00	171.00	212.00
Regrasp ph.	Head angle	190.00	223.00	223.00	215.00
Prepar.ph.	Shoulder angle	176.00	175.00	167.00	162.00
Release ph.	Shoulder angle	121.00	125.00	205.00	202.00
Flight ph.	Shoulder angle	11.00	16.00	40.00	58.00
Regrasp ph.	Shoulder angle	157.00	147.00	99.00	141.00
Prepar.ph.	Hip angle	199.00	218.00	146.00	132.00
Release ph.	Hip angle	103.00	121.00	200.00	142.00
Flight ph.	Hip angle	90.00	104.00	55.00	54.00
Regrasp ph.	Hip angle	212.00	138.00	117.00	173.00
Prepar.ph.	Knee angle	151.00	121.00	172.00	178.00
Release ph.	Knee angle	87.00	60.00	106.00	63.00
Flight ph.	Knee angle	71.00	66.00	51.00	57.00
Regrasp ph.	Knee angle	138.00	120.00	136.00	166.00

Release angle	28.00	23.00	10.00	9.00
Regrasp angle	1.00	7.00	40.00	59.00
Duration of the flight	0.92	1.00	0.80	0.92
max height of 8 ε 6	3.83	3.98	3.96	4.21

B. During the release phase:
Pegan has an extremely high vertical velocity which is more often obtained for the triple salto backward (Bruegeman 1994). Other velocities are similar to those found with other researchers.
Forward elements show great shoulder extension, while backward elements show flexion. The opposite situation is with the head angle.
Most gymnasts perform Gaylord I with hyper-extended hips, while Pegan releases the bar with flexed hips and very flexed knees. Those two movements do not change the angular momentum significantly, but allow the gymnast faster flexion, lower moment of inertia and angular acceleration. Pegan's forward kick can be used as a possible example of a good forward kick.
Backward elements have higher release angles (angle x axis - high bar - BCG), however our data for forward elements is much lower (Bruegeman 1994).
The relative force in the xy plane of BCG to the high bar is in a range with other researchers who measured mostly dynamic parameters (Krug 1992).

C. During the flight phase:
Only Gaylord I shows slightly shorter duration of the flight, if we calculate the angles of the release and the regrasp, we can presume there is no important difference in duration.
Pegan reaches the highest height of the BCG during the flight, this height is also rare among other elements e.g., triple salto backward.
All gymnasts are flexed, Kolman is less flexed because he performs also a rotation around the longitudinal axis, Pegan finishes 1 salto forward very tucked, then while opening performs also a half turn around the vertical axis.
Kolman performs his element like Tsukahara (half turn in the first part of salto, half turn in the second part of salto).
Pegan starts rotation around the longitudinal axis with the head and arms.
Kolman stops the rotations by stretching the body and splitting the legs (a mistake by the Code of points.

D. During the regrasp:
Forward elements have higher regrasp angles (angle x axis - high bar - BCG), Pegan has an extremely high regrasp angle. Pegan is consequently able to connect the next element without any problems, while others should perform some compensatory movements to continue. However Fajkusz performs Gienger salto after Kovacs.

Conclusion

The analysis of the Kolman and the Pegan saltos show their technical characteristics in comparison with the Kovacs salto and the Gaylord I saltos. As the Kovacs and the Gayord I are the first step in methods to learn the new flight elements, the most characteristic data of all four elements are presented here. The coaches should concentrate on the main differences between those elements in the preparation and release phase . According to these results they should prepare gymnasts in this direction and develop perhaps new flight elements if the gymnasts are able improve on these biomechanical data.

Literature:

Bruggemann G.P., P.J. Cheetham, Y. Alp, D. Arampatzis (1994). Approach to a biomechanical profile of dismounts and release-regrasp skills on the high bar. Journal of Applied Biomechanics, 10, 3, 291 - 312.

Cuk I. (1994). Some differences between the Kovacs and the Gaylord salto, ISBS, Siofok.

Krug J. (1993) Technik und techniktraining im geraetturnen. First Int. Conference Biomechanics in Gymnastics, proceedings p.95 to 114, Cologne, Bundesinstitut fuer Sportwissenshaft, 12/93.

Krug J., K. Knoll, R. Wagner, A.Bronst, H.D. Zocher (1992). Biomechanische Analyse von Flugelementen und Abgangen am Reck bei den EM 1992 der Maenner in Budapest, Institut fuer angewandte trainingswissenschaft Leipzig, Leipzig, 1992