

# **ADDUCTOR MAGNUS, RECTUS ABDOMINIS, SERRATUS ANTERIOR AND TRICEPS ACTIVITY DURING REVERSE PUNCH (GYAKU ZUKI) EXECUTION**

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## **INTRODUCTION**

Reverse punch technique may involve major muscles at proper time to increase momentum and so the resulted impact. Muscles sequence activation from the hip to the arm was summarized by Nakayama (1974). Kinesiology study revealed that punch is not only an elbow extension; shoulder medial rotation also contributes in muscular work. Karate Do initial posture is essential due to the execution of thigh medial rotation and so hip rotation. The purpose of the study is to determine muscular activity between Karate Do practitioners, once muscle preparation of thigh medial and shoulder medial rotations is a long term conditioning training. EMG activity of triceps, serratus anterior, adductor magnus and rectus abdominis was recorded.

## **METHODS**

Sample was constituted by two groups, with three males Karate Do amateur practitioners each. A first group of novice practitioners (NP), body mass of 86.77±21.24 kg and a second group of expert practitioners (BBP), body mass of 74.27±11.98 kg. Sample was selected by practitioner time disposal. After signed informed consent, anthropometry measures and skin preparation were made. EMG activity was recorded using surface bipolar disposable electrodes, model 31118733 (Kendall, USA), placed according to SENIAM Project recommendations.

Sample frequency was 2000 Hz. Reference electrode was located in the tibial tuberosity. EMG data was recorded using Miotoool and Miograph 2.0 software (Miotec, Biomedical Equipments-Brazil). SAD2 data acquisition software (Engineer Faculty, UFRGS–Brazil) was used for data analyze. Practitioners realized five reverse punches over a bag with a calibrated accelerometer in it (SANT'ANNA, 2007). A switch sensor elbow contacted, regulated vertically by means of physical characteristics of each practitioner, informed the exact start. Last instant was collected by wave impact at the bag. DI 740 series data acquisition device and WINDAQ software (DATAQ Instruments-USA) were used to collect switch sensor and impact data. Foot position was marked in the floor to propitiate a similar stance during execution. Distance between bag and fist was measured for later calculation of mean velocity. SPSS Statistical software was used to verify normality using Shapiro-Wilk Test ( $p \leq 0.05$ ). Groups were compared by Mann-Whitney U test ( $p \leq 0.05$ ) and relations between variables were analyzed by Spearman correlation.

## **RESULTS AND DISCUSSION**

Table 1 resumes EMG data and output variables. Net impact was normalized by body mass and is expressed as gravity acceleration (g) per kilograms. RMS data were normalized by average intensity for

each practitioners for further statistic analysis.

**Table 1:** Elapsed time (msec), Impact (g/kg), mean velocity (m/s) and mean RMS.

	NP	BBP
Time	245±47	217±72
Velocity	3.775±0.677	3.670±0.916
Impact	0.191±0.037	0.233±0.056
<b>Mean RMS (%)</b>		
Triceps	87.90±40.09	64.01±32.54
Serratil A.	116.64±60.89	79.37±34.72
Rectus A.	102.69±46.88	88.08±20.64
Adductor	96.24±43.49	97.12±56.55

Shapiro-Wilk test indicated normality only for a few data. Because of the small sample size (n=30) and high standard deviation, all data was considered non-parametric. Mann-Whitney U-test between groups revealed significance (U, 0.029; p<0.05) for normalized impact denoting differences between novice and experts to punch but did not explained EMG activity. Spearman analysis of EMG data, resumed in Table 2 can explained muscles patterns during movement. Correlation between mean velocity and adductor magnus activity suggest evidence that reverse punch as practice in Karate Do begins during pelvic movement induced by thigh medial rotation as an arrangement of posture. With the correlation between serratus anterior, adductor magnus and rectus abdominis activity, we can deduced that movement initiate in the lower limb and has a quick propagation through hip and thorax before arm movement. The experiment did not

found statistic evidence of triceps activity and impact but EMG activity of this muscle was higher than the others.

## SUMMARY/CONCLUSIONS

Comprehension of Karate Do techniques using EMG is recently. Such studies will explain training effects and physiologic changes due to body adaptation to great impact forces (GRIFFIN, 1990), once net impacts found were of 20 to 30 g. Instant analysis of RMS peak before and after impact are necessary and will help for further explanations. Increase sample is required to obtain necessary data and explain movement patterns.

## REFERENCES

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<http://www.seniam.org>

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**Table 2:** Spearman Analysis and correlation coefficients results for main results of the study.

	<b>Correlation Coefficient</b>				
	<b>Mean Velocity (m/s)</b>	<b>Triceps AI</b>	<b>Serratil A. BI</b>	<b>Rectus A BI</b>	<b>Rectus A AI</b>
<b>Serratus Anterior BI</b>	-.110	-.455(*)			
<b>Serratus Anterior AI</b>	-.260	.083	.401(*)		
<b>Rectus Abdominis BI</b>	.271	-.440(*)	.576(**)		
<b>Adductor Magnus BI</b>	-.363(*)	.017	.410(*)	.121	.445(*)
<b>Adductor Magnus AI</b>	.513(**)	-.026	.358	.399(*)	.045

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

AI and BI= EMG activity after impact and before impact.