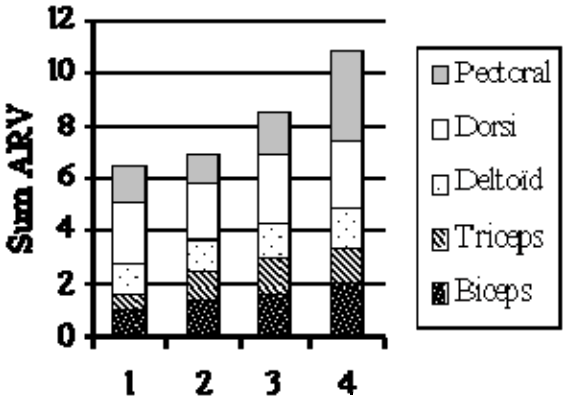
Muscular activity of the backhand and forehand top spins in top table tennis players : implications for physical training

S. Ambrosino, F. Borrani, O. Skénadji, J.P. Micallef and G.P. Millet
Faculty of Sports, ave. Pic Saint-Loup, Montpellier, France, ambrosino.stephane@caramail.com

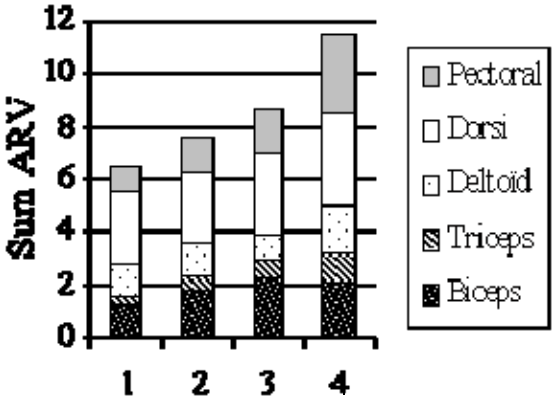
Introduction. Until now there has been no study carried out on the muscular activity of top table tennis players. But now muscular training is playing an increasingly important role in the development of the sport and likewise with the contribution of the different muscular groups involved in different shots and when using different levels of intensity. The aim of the present study was to quantify the activity of the biceps, triceps, pectoral muscle, deltoid muscle and latissimus dorsi muscle amongst top level table tennis players - both for forehand (CD) and back-hand (REV) tops spins and in relation to different ball speeds. **Methods.** 7 subjects (age: 24 ± 5 years ; height : 181 ± 5 cm ; weight : 71,3 ± 3,7 kg) top level (within the French Table Tennis Federation 2346 ± 164 points) carried out 8 exercises of 30 s of backhands and fore-hands at 4 different ball speed levels. The acquisition of electromyographic signals from each muscle was carried out with surface electrodes using the Bagnoli (Delsys, USA) system - at a frequency of 1024 Hz . The average rectified values (ARV) were then worked out and the balls speeds measured accordingly (radar Speed Check, Canada). **Results.** The 4 ball speeds were different . (V1 : 27 ± 5 vs 31 ± 6 ;V2 : 43 ± 3 vs 40 ± 7 ; V3 : 57 ± 6 vs 53 ± 7 ; V4 : 92 ± 8 vs 88 ± 11 $km \cdot h^{-1}$ for backhand or forehand, respectively). Yet no difference was observed between backhand and forehand. The ARV of the 5 muscles studied in both forehand and backhand is shown in table 1.

EMG CD Elite



Ball Speed

EMG REV Elite



Ball Speed

The sum of ARV is not different to an equivalent speed between forehand and backhand. The relative participation of each muscle is different according to the different speeds used. The sum of ARV is significantly different between V1 and V4 in the pectoral muscle (CD: 0,93 ± 0,24 vs. 2,95 ± 0,33 ; REV : 1,28 ± 0,47 vs 3,48 ± 0,34), the triceps (CD : 0,28 ± 0,12 vs 1,06 ± 0,13 ; REV : 0,61 ± 0,16 vs 1,46 ± 0,30) and the biceps (CD : 1,22 ± 1,08 vs 2,13 ± 0,54) No other difference was found. The sum of ARV and the ball speeds were then correlated. : (R^2=0,996). **Discussion and Conclusion.** The muscles studied can be said to have different functions and uses. The latissimus dorsi muscle and the deltoid muscle are mainly involved in V1. The great effort involved at this intensity consists of maintaining the arm in an appropriate position. The relative contribution of the biceps and the pectoral muscles is most important at V4, their role is to increase the power of shots played. The biceps seems to play a more significant role in high speed forehands. It is worth remembering that in table tennis no less than 82% of points are scored at the third hit of the ball ; which indicates that power is indeed a key factor when it comes to performance. This in turn demonstrates the interest of power and speed related training in relation to the biceps, triceps and pectoral muscles. This demonstrates that amongst those top players who have developed the qualities of muscle control, a specific physical training aimed at an improvement in strength can indeed lead to greater ball speed.

A process oriented approach for match analysis in table tennis

A. Baca and R. Baron

Department of Sport Science, University of Vienna, Auf der Schmelz 6, A-1150 Wien, Austria
arnold.baca@univie.ac.at

In order to identify strengths and weaknesses in the technical and tactical behaviour of racket sports players and to find out possible reasons, structure and process oriented models of the match are constructed. If process oriented models are used, the temporal evolution of the match may be described. This approach has successfully been applied to table tennis (e. g. Boguschewski et al., 1994, Tischtennis Lehre, 8 (1), 5-8). It has therefore been selected to analyse and improve the behaviour of players of the Austrian national and youth national team. In addition, methods from exercise physiology (acquisition of physiological parameters during training and competition) and sports psychology are applied.

In cooperation with trainers and players of the Austrian national team a model has been developed for a process oriented description of the match. In addition to grip (shakehand / penhold), left/right handed, type of player (offensive/defensive) and rubber sheet, the model comprises information on

- the positions of the players, the bat w.r.t. the player and the ball when hitting the table
- the times when the ball is hitting the table
- strokes (forehand/backhand, topspin, block, flip, smash, etc.)
- ball speed, spin and height over net
- service techniques
- errors and special events.

Matches are recorded by a video camera and evaluated afterwards. The possibility to record heart rates synchronized to the video has been provided. Heart rates can therefore be analysed in relation to observable actions of the match. Since the times, when the ball is hitting the table are registered by using the time code information from the digitised video, selected scenes (e. g. related actions found out by using filter functions) may be displayed sequentially with digital video.

Since only some matches have been evaluated so far (the system will be employed more intensively from January to April, 2003) only partial results are available at the time of writing. From these, it may be concluded that the method is applicable to answer questions from practice, such as

- Where should the first ball be placed ?
- How to play to attain a topspin attack possibility ?
- Which service was most successful ?
- Which return on a specific service was most successful ?

It is expected that unknown, new and potentially useful information will be found, if larger data sets are available. Methods from artificial intelligence and data mining are to be used for this purpose.

Based on the results of the analysis feedback has been and will be given to trainers and players or feedback systems will be applied in training. One aim is the quick presentation of selected meaningful video scenes. Another is to give the player immediate acoustic or optical feedback in training on the position and/or quality of the ball just played. Methods for detecting the point, where the ball hits the table automatically in real time are under development. One approach is to fix three accelerometers onto the underside of the table and to determine the hitting point from the vibration signals. From first experiments it is expected that the method will be accurate enough.