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KNEE STRENGTH MEASUREMENT: CAN WE SWITCH BETWEEN ISOKINETIC DYNAMOMETERS?

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Abstract

BACKGROUND: Isokinetic evaluation is considered the gold standard in muscle strength measurement due to its sensitivity, intra-dynamometer reproducibility and usefulness in the injury prevention screening and follow up of subjects with musculoskeletal pathologies, neurological disease or after surgical operation. However, can one switch among different isokinetic dynamometers for the purpose of knee muscles evaluation?

OBJECTIVES: To comprehensively evaluate the compatibility of the isokinetic short concentric and eccentric strength evaluation protocol and of the fatigability resistance evaluation between three different isokinetic devices.

METHODS: Eighteen recreationally active men underwent three isokinetic knee testing sessions on three different isokinetic devices with 7–10 days of rest between each session. Relative (Pearson's r product-moment correlation coefficient – PCC) and absolute (standard error of measurement – SEM, Cohen effect sizes (d) and probabilistic inferences – MBI) parameters of reproducibility were determined to assess the inter-dynamometer agreement.

RESULTS: For the short concentric and eccentric strength evaluation protocol, the extensors in concentric mode and the flexors in eccentric mode can be compared (eventually with transposition formulas provided) between Biodex, Con-Trex and Cybex (almost all PCC ≥ 0.80). The DCR could be compared between Con-Trex and Cybex and between Biodex and Cybex pairs (eventually with transposition formula provided). For the fatigability resistance evaluation protocol, the total sum can be compared for extensors (eventually with transposition formulas provided) for PM for all dynamometer pairs considered and, in the case of MW, only for Biodex and Con-Trex (PCC ≥ 0.80).

CONCLUSIONS: Only some of the parameters derived either from the short concentric and eccentric strength evaluation protocol or the fatigability resistance evaluation protocol may be interchangeable

providing transposition formulas are applied. Otherwise, isokinetic findings are largely system-dependent save some specific instances.

Keywords: Compatibility, reproducibility, Biodex, ConTrex, Cybex, inter-dynamometers, strength profile, fatigability, fatigability resistance evaluation protocol, transposition formulas

1. Introduction

Over time, isokinetic testing became the gold standard in muscular strength evaluation due to its sensitivity and intra-dynamometer reproducibility [1–5] both in research and in the clinical context [6]. Because of its use in the context of longitudinal assessments in the same subject or cross-evaluation in several subjects, it may be necessary to compare data obtained on different devices since researchers and clinicians use different dynamometers. Indeed, the muscular capacities are, among others, often a key element in the follow up of subjects with musculoskeletal pathologies, neurological disease or after surgical operation. In addition to the intra-dynamometer reproducibility, which has previously been shown to be generally good for the most frequently used dynamometers [1–6], it is also required to assess the inter-dynamometer compatibility or, in other words, the reproducibility of measurements between multiple dynamometers.

The analysis of previous articles [7–15] reveals nonuniform and non-generalizable conclusions: one shows a good compatibility [9], while the others show a nonuniform compatibility between parameters (PM, MW, power, ratio), muscles (knee extensors or flexors) and speed [7,8,10–14]. The apparent inconsistencies between these different studies could be explained by the disparities in protocols: different ranges of motion (ROM): 60°, 80°, 90° or 100°, angular velocities: 60°/s, 180°/s, 240°/s and/or 300°/s, muscle contraction mode: concentric only or concentric and eccentric, parameter computed: PM, MW, power and/or angle of PM, number of subjects: 9–63, different gravity compensation methods: no compensation, static compensation or dynamic compensation and different protocol design: tests on the same day on a different device or on two separate days with rest in between.

However, almost none of these studies has been done recently [8–15] (only one in the past 10 years [7]), and one wonders whether the technological progress observed in the isokinetic evaluation field resulted in improved compatibility between dynamometers used in clinical and research environments. This question deserves to be treated rigorously and exhaustively. For example, can one freely and without constraints switch between different isokinetic dynamometers for the knee evaluation? Does this switch allow the use of same data or does it mandate the application of transposition formulas? To answer these questions we have compared three devices that cover the largest share of the market: the Biodex System 3 Pro, the Con Trex MJ PM-2 and the Cybex Humac CSMI. in performing an isokinetic concentric and eccentric strength and fatigability evaluation of the knee extensors and flexors.

2. Methods

2.1. SUBJECTS

Eighteen recreationally active men, with no history of knee injury, practicing fewer than six hours of physical activity per week and not involved in specific muscle training of the lower limbs were included in this study. Any drug or medication intake was an exclusion criterion. This study, approved by the Ethics Committee of the University and Faculty Hospital, was conducted in conformity with ethical standards and international laws [16] and with the Helsinki Declaration of 1975, as revised in the year 2000. All subjects were informed about the protocol, submitted to a medical examination and signed an information and consent form. Age, size and body weight means ± SD were 23.4 ± 2.4 years, 181.7 ± 7.2 cm and 84.9 ± 13.1 kg, respectively.

2.2. EXPERIMENTAL DESIGN

Three isokinetic testing sessions were carried out with the three isokinetic dynamometers, with seven to ten days of rest between each session, for each subject under the supervision of a single researcher. These were done in randomised order. Identical isokinetic tests were done at the same time of day. To avoid possible effects of a residual fatigue due to recent exercise, subjects were asked to refrain from physical activity for forty-eight hours before each evaluation session. In order to standardize the testing session conditions, the subjects were asked (1) to follow a stable sleep schedule in the three days before the sessions and (2) to abstain from drinking coffee, tea or any other energy drink on the day of the sessions.

2.3. ISOKINETIC DYNAMOMETER

The three isokinetic dynamometers were Biodex System 3 Pro (Biodex Medical Systems, Shirley, NY), Con-Trex MJ PM-2 (Con-Trex, CMV AG, Dübendorf, Switzerland) and Cybex Humac CSMI (Computer Sports Medicine Inc., Stoughton, MA). These three devices have excellent reliability: the Biodex has an ICC of 0.99 for position, PM and velocity (3), the ICC is higher than 0.99 (PM and MW) for the Con-Trex (4) and the Cybex has an ICC of at least 0.93 and 0.89 respectively for PM and MW (5).

2.4. PROTOCOL

Only the dominant leg, defined as the kicking leg, was tested. The subject was sitting in a seat with the hip flexed at an angle of 90° between trunk and thigh. Straps were applied to the thigh tested, pelvis and shoulders. The knee's axis of rotation was aligned with the dynamometer's axis of rotation by using the external condyle as an anatomical landmark. The press hold was positioned three centimetres above the external malleolus on the front side of the leg. Range of motion (ROM) was set to 100° with 0° corresponding to a maximum active extension. Subjects were instructed to push up and pull down, until the dynamometer stopped, to achieve the full ROM. The weight of the leg was measured and its influence on performance was automatically taken into account through the dynamometer software.

To ensure familiarisation and to complete the setup and warm-up, the subjects made submaximal but progressively intensified concentric contractions at 120°/s [17].

The testing protocol included exertions of both knee extensors and flexors at concentric 60°/s (3 repetitions), concentric 240°/s (5 repetitions) and eccentric 30°/s (3 repetitions) angular speeds [17]. Afterward, due to the resurgence over recent years of the fatigability resistance evaluation protocol [18–23], the subjects performed thirty consecutive maximal reciprocal concentric contractions at the angular velocity of 180°/s [23]. All sets of testing were separated by one minute of rest. Before assessment, three preliminary submaximal repetitions routinely preceded each test speed. No visual feedback was given during the test [17].

Throughout the fatigability resistance evaluation protocol, subjects were asked to perform at their best from the first repetition, and during each subsequent repetition, all along the full ROM previously determined. To motivate the subjects to develop the highest PM and MW at each repetition, the researcher intensely verbally encouraged them throughout the test [24].

2.5. DATA ANALYSIS

Peak moment (PM in N·m) and maximal work (MW in J) were computed for each repetition. The MW, although frequently neglected, has been included in our analyses due to the differences in information provided by these two parameters; the PM represents the highest moment produced during a given contraction, while the MW is the area under the moment curve [23,25]. As reported by Manca, Solinas [26], Morrissey [27] aPM-only based analysis may induce an overestimation of the muscular moment output. Therefore, the MW may serve as a better muscle function indicator than PM, especially in the rehabilitation process [28] and in frail populations. Considering these elements, it seemed essential to comprehensively assess the reproducibility of the indexes based not only on PM but also on the MW.

For the short concentric and eccentric strength evaluation protocol, only the best repetition was analysed. This was defined as one in which the PM was the highest and was identified separately, whether for flexors and extensors or for angular velocity. In addition to the best repetitions at each angular velocity, we computed and evaluated the inter-dynamometer compatibility of three agonist/antagonist muscle pair ratios: two conventional extensor/flexor ratios calculated for the same speed of concentric contraction (60°/s and 240°/s) and a Dynamic Control Ratio (DCR) which was the quotient of the flexors' eccentric PM at 30°/s and the extensors' concentric PM at 240°/s [29].

For the fatigability resistance evaluation protocol, as previously demonstrated [30], the derived fatigability parameters have an insufficient intra-dynamometer reproducibility for use in the clinical and/or scientific context; therefore they have not been analysed. For the extensors, eleven measured fatigability parameters were used (see Table 1). For the flexors, the total sum and partial sums of ten contractions were analysed, even if their intra-dynamometer (inter-session) reproducibility should be considered with caution [30].

2.6. STATISTICAL ANALYSIS

The normality of the distribution of the data was verified using the Shapiro-Wilks test. When this was violated, data were log-transformed (provided that the normality of the distribution of log-transformation was verified).

Relative reliability was measured by the Pearson's r product-moment correlation coefficient (PCC) and linear regression analyses with associated coefficients of determination (r^2). The PCC corresponds to the covariance of the two variables divided by the product of their standard deviations. "These correlations quantify the direction and the strength of the relationship between test-retest scores by estimating their linear relationship, and lie between +1 and −1" [31]. Threshold values for PCC statistics were < 0.20, 0.20, 0.60 and 0.80 for weak, moderate, strong and very strong, respectively [32].

Absolute reliability, related to the variation of the value of a parameter, was assessed by standard error of measurements (SEM) [33,34] and magnitude-based inferences (MBI) [35]. $SEM \leq \frac{SD}{2}$ was taken as the criterion for acceptable absolute compatibility [36–41]. Cohen's effect sizes (d) (95% CI) or inter-group standardised differences were computed by pooled standard deviations. With 0.2 between-subject standard deviation considered as the smallest worthwhile difference (SWD), threshold values for d statistics were: lower than 0.20 for trivial difference and higher than 0.20, 0.60, 1.20 and 2.00 respectively for small, moderate, large and very large differences. The probabilistic inferences (or MBI) about the true standardised magnitude in the means between groups were calculated. In other words, this corresponded to the probabilities that the true (unknown) differences were lower, similar or higher than the SWD as calculated. Values lower than 1% corresponded to almost certainly no difference in probability, while values higher than 1%, 5%, 25%, 75%, 95% and 99% corresponded respectively to very unlikely, unlikely, possible, likely, very likely and almost certainly different probability. The true difference was considered as unclear if the chance of simultaneous higher and lower values was higher than 5% [35].

For the results' transposition formulas, a linear equation of the basic form "y = ax + b" was used with *a*, the coefficient of *x*, and *b*, an independent term or constant determined by the linear least squares, which consists of minimising the differences between the observed responses in the dataset of one dynamometer and the observed responses in the dataset of another dynamometer (abnormal values excluded). To calculate the transposition formulas, on one hand we separated concentric and eccentric values, and on the other hand separated PM and MW. To obtain the transposition formulas for the fatigability resistance evaluation protocol, we pooled data from five repetitions to smooth the data due to its inherent variability. r^2, the coefficient of determination between pooled data (concentric or eccentric values for PM or MW) from two dynamometers (with CI 95% and associated *p*-value), and MBI between transposed data by formulas and measured data were calculated to assess the global fitting of the results' transposition formulas. We report about the utilization directly in Tables 5 and 6.

Statistical significance was set at a *p*-value < 0.05 for all analyses and confidence intervals were fixed at 95%. All calculations were made with Statistica 10 (Statsofts, Tulsa, OK), MedCalc 13.3.3 (MedCalc Software, Ostend, Belgium) and Excel 2013 (Microsoft, Redmond, WA).

3. Results

The data compatibility (PCC with CI 95% and associated *p*-value & MBI) are presented in Tables 3 and 4 respectively for short concentric and eccentric strength evaluation protocol and the fatigability resistance evaluation protocol. The transposition formulas (completed by r^2 with CI 95% and associated *p*-value & MBI) are available in Tables 5 and 6. A summary of the inter-dynamometer compatibility and the procedure to be followed in case of comparison are presented in Table 2.

3.1. SHORT CONCENTRIC STRENGTH EVALUATION PROTOCOL

3.1.1. BIODEX AND CON-TREX

The extensors presented a high relative compatibility; the PCC, whether for the PM or the MW, were almost all higher than 0.8. The criterion for acceptable absolute compatibility was met, although Con-Trex seemed to overvalue the numbers (except for the PM at 60°/s).

The flexors had a high relative compatibility, with the PCC at about 0.8 for MW and a moderate relative compatibility with the PCC at about 0.7 for PM. Except for the MW at 60°/s, the values obtained were not acceptable for absolute compatibility (the values of Con-Trex are higher than those of Biodex (60°/s vs. 240°/s, whether for PM or MW).

3.1.2. BIODEX AND CYBEX

The extensors presented a very high relative compatibility, whether for PM or MW, with almost all PCC higher than 0.8. The criterion for acceptable absolute compatibility was met, even though Biodex seems to overvalue the numbers at 240°/s.

The flexors presented a weak relative compatibility, whether for PM or MW; the PCC are all lower or just above 0.7. The absolute compatibility was unacceptable, whether for PM or MW. Moreover, the Biodex seemed to overvalue numbers compared to Cybex at 240°/s.

3.1.3. CON-TREX AND CYBEX

The extensors presented, excePM for MW at 240°/s (r = 0.724 [0.389/0.890]), a high relative compatibility. The criterion for absolute compatibility was met, whether for extensors and flexors or for PM and MW, even though Con-Trex values seemed higher than Cybex's (except for the PM at 60°/s).

The flexors presented a high relative compatibility at 60°/s for PM but a moderate to weak relative compatibility for other speeds and/or parameters. Except for the PM at 60°/s, the absolute compatibility was very weak and Con-Trex seemed to overestimate the values compared to those derived from the Cybex.

3.2. SHORT ECCENTRIC STRENGTH EVALUATION PROTOCOL

3.2.1. BIODEX AND CON-TREX

The extensors presented a very weak relative compatibility, whether for PM or MW, with PCC lower than 0.6. The absolute compatibility was also very weak, with Biodex values higher than those of the Con-Trex.

The flexors had a high relative compatibility, with PCC higher than 0.8 for PM and MW. Although Biodex seemed to overestimate the values compared to Cybex, the criterion for acceptable absolute compatibility was met for PM and MW.

3.2.2. BIODEX AND CYBEX

The extensors had a very weak relative and absolute compatibility, with PCC lower than 0.6 for PM and MW and an unacceptable absolute compatibility according to the SEM criterion.

The flexors presented a high relative compatibility for PM and a moderate one for MW, with PCC about 0.85 and 0.74 respectively. The absolute compatibility met the acceptance criterion even though the Biodex values were higher than those of Con-Trex.

3.2.3. CON-TREX AND CYBEX

The extensors presented a very weak relative compatibility for PM and MW, with PCC about 0.5 and 0.6 respectively. The absolute compatibility was unacceptable according to the SEM criterion, whether for PM or MW, for the extensors.

With a PCC of about 0.9 and 0.8 respectively for PM and MW, the flexors had a very high relative compatibility. The absolute compatibility met the criterion for acceptable absolute compatibility. Nevertheless, the Con-Trex values were higher than those of Cybex.

3.3. SHORT STRENGTH PROTOCOL RATIOS

3.3.1. BIODEX AND CON-TREX

The DCR and conventional ratios had a very weak relative and absolute compatibility (unfilled SEM criterion).

3.3.2. BIODEX AND CYBEX

The DCR had a moderate to high relative compatibility, with a PCC of 0.776 [0.484/0.912]; the conventional ratios (at 60°/s and 240°/s) presented a weak relative compatibility, with ICC lower than 0.6. The absolute compatibility met the SEM criterion for DCR (even though Biodex seemed to overestimate the values compared to Cybex) but not for conventional ratio at 60°/s and 240°/s.

3.3.3. CON-TREX AND CYBEX

The DCR and conventional ratio at 60°/s had respectively a high and moderate relative compatibility, whereas the conventional ratio at 240°/s presented a weak relative compatibility with PCC lower than 0.6.

The absolute compatibility was unclear for the DCR, although there seemed to be an 80% chance that the values were similar between Con-Trex and Cybex. The SEM met the criterion for acceptable absolute compatibility for DCR but not for the conventional ones.

3.4. FATIGABILITY RESISTANCE EVALUATION PROTOCOL

3.4.1. BIODEX AND CON-TREX FOR EXTENSORS:

- the best repetition (BR_1) and the total sum (Σ*[R1:R30]*) presented a high relative compatibility, with PCC higher than 0.8;
- the first partial sum by five or ten repetitions (Σ*[R1:R5]*, Σ*[R6:R10]*, Σ*[R11:R15]*, Σ*[R1:R10]* and Σ*[R11:R20]*) had a moderate to high relative compatibility, with PCC higher than 0.75;
- the last partial sum by five or ten repetitions (Σ*[R16:R20]*, Σ*[R21:R26]*, Σ*[R26:R30]* and Σ*[R21:R30]*) had a weak to moderate relative compatibility.

The absolute compatibility for extensors was good for the best repetition (BR_1) and the total sum (Σ*[R1:R30]*), whether for PM or MW, and for the majority of first partial sums by five or ten repetitions (Σ*[R6:R10]*, Σ*[R11:R15]*, Σ*[R1:R10]* and Σ*[R11:R20]*) only for PM. Nonetheless, the values of Con-Trex for the best repetition for MW ($BR_{1\,MW}$), the first partial sum by ten repetitions for MW ($\Sigma[R1{:}R10]_{MW}$) and the first partial sum by five repetitions for PM and MW (Σ*[R1:R5]*) seemed to be higher than those of Biodex. Finally, the other partial sums for PM, and almost all partial sums for MW, did not meet the criterion for absolute compatibility.

For flexors, the best repetition (BR_1) had a high relative compatibility, with PCC higher about 0.8 for PM and MW. The total sum (Σ*[R1:R30]*) and first partial sums of ten repetitions (Σ*[R1:R10]* and Σ*[R11:R20]*) presented a moderate relative compatibility for PM and MW, while the last partial sums (Σ*[R21:R30]*) had a weak relative compatibility, also for PM and MW. The absolute compatibility for flexors was weak for PM and MW, with Con-Trex values higher than those of Biodex.

3.4.2. BIODEX AND CYBEX

For extensors, the best repetition (BR_1), the total sum (Σ*[R1:R30]*) and the first partial sums by five or ten repetitions (Σ*[R1:R5]*, Σ*[R6:R10]*, Σ*[R11:R15]*, Σ*[R1:R10]* and Σ*[R11:R20]*) had a high relative compatibility for PM. For MW, only the best repetition (BR_1), the Σ*[R1:R5]*, the Σ*[R6:R10]* and the Σ*[R1:R10]* had a high relative compatibility. The other parameters had a weak to moderate relative compatibility.

The absolute compatibility for extensors met the criterion to be considered as acceptable, although Biodex seemed to overestimate the values compared to those of Cybex.

ExcePM for the total sum of PM ($\Sigma[R1{:}R30]_{PM}$), which presents an almost good relative compatibility (PCC = 0.751 [0.437/0.902]), the flexors had a weak relative compatibility for measured parameters, with PCC lower than 0.7 for the fatigability protocol (whether for PM or MW). The absolute compatibility was very weak; Biodex had higher values than Cybex for all parameters (excePM for extensors $\Sigma[R1{:}R5]_{PM}$), whether for flexors and extensors or for PM and MW.

3.4.3. CON-TREX AND CYBEX

For extensors, all measured parameters had a high relative compatibility for PM; only two partial sums (Σ*[R16:R20]* and Σ*[R16:R20]*) had a PCC of about 0.75 while the others were above 0.8. For the MW, only the best repetition (BR_1) had a high relative compatibility, whereas partial sums by five or ten repetitions had a weak to moderate relative compatibility, with almost all PCC measuring between 0.6 and 0.8.

The SEM met the criterion for acceptable absolute compatibility for almost all parameters (except Σ*[R16:R20]* and Σ*[R16:R20]*) for PM and for half of the parameters for MW (best repetition (BR_1), the total sum (Σ*[R1:R30]*) and first partial sums), although Con-Trex seemed to overestimate the values compared to those of Cybex.

The flexors had, whether for PM or MW, a weak relative compatibility for measured parameters, with PCC lower than 0.7 for the fatigability protocol. The absolute compatibility, whether for flexors and extensors or for PM and MW, was very weak. Con-Trex values were higher than the Cybex values for all parameters.

4. Transposition formulas

The normalisation of the data to allow the comparison between dynamometers, when the relative compatibility is sufficient, is the reason why transposition formulas exist. Logically, the relative reproducibility between modelling values and values of another dynamometer is the same as the relative reproducibility between real values and values of a dynamometer; only the absolute compatibility is modified.

For each pair of dynamometers, for the short concentric and eccentric strength evaluation protocol, there are two transposition formulas for the PM and two for the MW: one for concentric contraction (60°/s and 240°/s) and one for eccentric contraction (30°/s) (see Table 5). Moreover, there is a transposition formula for the ratios (see Table 5). For the fatigability resistance evaluation protocol, there are two transposition formulas in total: one for the PM and one for the MW (see Table 6).

To normalise a value, it must be multiplied by the coefficient and then the constant added. For example, to transpose a partial sum by five repetitions for the extensors PM of 220 N·m obtained on a Biodex in concentric mode at 60°/s, to a "Cybex value", it is necessary to multiply it by 1.062 and then subtract 10.096 N·m. Therefore, the modelling value is 223.6 N·m for this example. Noteworthy the coefficient and the constant are not the same if one transposes some value from dynamometer A to dynamometer B or the opposite.

For the short concentric and eccentric strength evaluation protocol, the transposition formulas, if used in compliance with the recommendations (see Table 5), improve the absolute compatibility:

- in 100% of cases for the recommendation "use with transposition formula" by a 45% average increase in the chances of transposed data being similar compared to measured data;
- in 88% of cases for the recommendation "use with (great) caution transposition formula" by a 25% average increase.

For the fatigability resistance evaluation protocol, if used in compliance with the recommendations (see Table 6), the transposition formulas improve the absolute compatibility in 68% of cases (by a 24% average increase in the chances of transposed data being similar compared to measured data) and in 70% of cases (by a 23% average increase) respectively for the recommendations "use with transposition formula" and "use with (great) caution transposition formula".

5. Discussion

In this study we have evaluated the compatibility of isokinetic concentric and eccentric strength and fatigue evaluation in the knee extensors and flexors amongthree devices that cover the largest share of the actual market. Our objective was not to reconsider the use of a specific brand of dynamometer, but to analyze the inter-dynamometer agreement. The major finding of our study is that compatibility problems still exist and are not yet solved.

Since 1987, a few researchers have assessed the compatibility for the knee isokinetic evaluation with Biodex, Con-Trex or Cybex [7–15,42,43]. Nevertheless, these experimentations:

- related non-uniform and non-generalizable conclusions;

- used different protocols [heterogeneity in range of motion (from 60 to 100), heterogeneity in angular velocities (from 60/s to 300/s), different parameters computed, heterogeneity in number of subjects selected, different gravity compensation and different protocol design];
- were performed “simultaneously” on two dynamometers only; Lund, Sondergaard [9] and Greenberger, Wilkowski [42], both using Biodex/ Cybex/Kincom, are the only two research teams that have studied three dynamometers for the knee joint [4];
- were interested only in the PM and did not analyze the maximal work (MW), with the exception of Keilani, Posch [8], Bandy and McLaughlin [12] and Gross, Huffman [5,13];
- analyzed only the short strength evaluation protocol and did not explore a fatigability resistance evaluation protocol, except for Keilani, Posch [8] in 2007;
- did not assess the eccentric extensors compatibility, except Araujo Ribeiro Alvares et al. [7].

These observations and conclusions are of significance to clinicians and researchers who perform knee muscles evaluations. Indeed, even if the bilateral comparison can still be realized, several problems related to the lack of compatibility may be encountered:

- The DCR has been shown to have some predictive value regarding hamstring injury in different sports [17,44,45]. However, if the cut-offs are not calculated specifically on each dynamometer, the risk of false-positives or false-negatives is very important with all the consequences that these results can generate, in particular, a waste of precious time in the rehabilitation/training process or an increased risk of injury. Both of these have the same consequence, a decrease in performance capacity
- Longitudinal follow-ups during rehabilitation or for preventive objectives, should be carried out on the same dynamometer (single make) otherwiseit will not be possible to use previous data in the control process. This situation is encountered especially during the retesting, during a transfer of a player from one club to another, or if a patient changes hospitals
- Multicentre studies can only be carried out in locations using the same dynamometer model, otherwise the data cannot be pooled; this limits the interest in a multicentre study. By the same token, meta-analyses should compare data from identical dynamometers or at least categorize the data according to the dynamometer.

The motivation for this study was not only to assess the inter-dynamometer compatibility, but also, if applicable, to design a way to transpose data from one to another device. To our knowledge, transposition formulas have never been proposed before. Usually, the studies concluded that different dynamometers could or could not be compared, but with the present formulas some detour may be possiblelol. Obviously, the transposition formulas were computed from our data, although having avoided over-fitting to ensure the predictive accuracy [46]. They can be refined with an increase in the number of subjects, but the bases are given to all clinicians and researchers. The recommendations (see Tables 5 and 6) can guide all Biodex, Con-Trex and Cybex users, even if applying the formula remains their responsibility.

The main findings emerging from this study are that the extensors in concentric mode and flexors in eccentric mode may be compared (eventually with transposition formulas). Our observations of lower inter-dynamometer reproducibility for flexors in the concentric mode than for extensors in same mode are similar to those of Bosquet, Maquet [23] and Croisier [47] in intra-dynamometer comparison. Their explanation for this finding related to the lack of specificity of the concentric isokinetic testing relative to the physical activity: in sports, the functional role of the hamstrings is to decelerate the lower leg, by eccentric contraction during rapid concentric contractions of the knee extensors, not to produce force by concentric contraction. This specificity deficit could therefore explain a part of their lower reliability during the test. Moreover, the inter-dynamometer reproducibility seems lower for eccentric than concentric contraction, as demonstrated by Impellizzeri, Bizzini [5] and therefore this trend is not surprising in inter-dynamometer.

Due to its importance in hamstring injury [17], the DCR could be compared first between Con-Trex and Cybex (without transposition formula), and second between Biodex and Cybex (with transposition formula).

For the fatigability resistance evaluation protocol, the trends from the inter-dynamometer compatibility analysis with Biodex, Con-Trex and Cybex are that:

- for the extensors, the total sum (Σ*[R1:R30]*) can be compared (eventually with transposition formulas) for PM in all dynamometer pairs considered, and for MW in Biodex and Con-Trex. The other total sums for MW can be viewed with precaution (with transposition formulas);
- for the flexors, the total sum can be compared cautiously for Biodex and Cybex (PM only) and Biodex and Con-Trex (PM and MW).

Globally, Cybex seems to provide lower values than Biodex and Con-Trex. Biodex seems to provide higher values than Con-Trex in eccentric contraction, while the opposite is true for short concentric strength evaluation protocol. During the fatigability resistance evaluation protocol, the Con-Trex seems to overstate values compared to Biodex for flexors; for extensors, the value seems to be equal between the two dynamometers. These observations could be explained by (1) different data compilation processes between the brands and (2) inconsistent comfort of use for the subject between the different dynamometers (different sitting position and different foam thicknesses between the press hold and the tibia, which must absorb the pressure generated by contractions of the extensors). Obviously, an unpleasant sensation could lead (consciously or not) to sub-maximal contractions and thus explain the heterogeneity of the values obtained.

Our values of standard error of measurement [23, 48,49] for the short concentric and eccentric strength evaluation protocol (not reported) are similar to those of a previous report [7] for extensors and flexors and for both contraction types. Nevertheless, the ICCs were higher than those we measured before (unpublished communication) even though the number of subjects was similar (18 versus 25). As we also conclude, even though the eccentric speed is not the same (60°/s versus 30°/s), de Araujo Ribeiro Alvares, Rodrigues [7] reported a lower relative and absolute compatibility for the DCR than for the extensors in concentric or for the flexors in eccentric. In an earlier study (2007), with the material evolutions that this implies, Keilani, Posch [8] concluded that the difference between the dynamometers increased with increasing angular speed, in the concentric mode both for the extensors and the flexors. This conclusion is consistent with our data since the absolute compatibility is lower at 240°/s than at 60°/s. To our knowledge, Keilani, Posch [8] are the only ones who have studied the inter-dynamometer compatibility of a fatigability resistance evaluation protocol between Biodex and Cybex. However, their analyses were based on an endurance ratio, and it has been shown that such indices cannot be used due to insufficient inter-dynamometer reproducibility [50]. So we will not compare our results with those of Keilani, Posch [8].

The sample size was a limitation of this study. Despite the fact that it is in agreement with the recommendation that reliability protocols should be studied in 15–20 subjects [28,51], further studies are warranted to confirm the present results over a larger sample size. Another limitation was that this study focused only on the knee joint. It would be highly interesting to assess the inter-dynamometer compatibility for other joints. Finally, the findings of the present study, as a precautionary measure, should not be generalized to populations other than healthy male subjects.

6. Conclusions and practical applications

Fifty years after the commercial introduction of isokinetic dynamoemetry, individual systems are incompatible with each their in terms of test results. This statement is somewhat qualified by the fact that some parameters of the short concentric and eccentric strength evaluation protocol (extensors in concentric mode and flexors in eccentric mode) or of the fatigability resistance evaluation protocol (total sum for extensors) may be compared, providing transposition formulas are applied.

Despite the transposition formulas the cut-off values and normative data should be individualized for each dynamometer for the setting of parameters. With these values for the relevant parameters, multicentre research studies, meta-analysis papers, and globally multi-devices protocols may be considered with confidence. As such, the present findings can partially explain the differences observed between reported values by different studies in similar populations.

7. Transposition formula – general considerations

By crossing the statistical data of relative and absolute compatibilities, three major conclusions and subsequent procedures emerge:

- if the relative and absolute compatibility is high, the data can be compared between the two dynamometers considered (advices √ and !√ explained in *Statistical analysis* section);
- if the relative compatibility is high but the absolute compatibility is insufficient, the data can be compared between the two dynamometers only after considering calculated transposed data by formulas provided (see Tables 5 and 6) (advices *f* and ! explained in *Statistical analysis* section);
- if the relative compatibility is insufficient, the data cannot be compared between the two dynamometers considered (advice X explained in the *Statistical analysis* section).

The transposition formulae are computed by using linear regression for two main reasons: first, because the other regression models do not enhance sensibly the coefficient of determination; and second, to avoid the over-fitting process, which generally reduces predictive accuracy [46].

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Ethical considerations

The study was approved by the Institutional Review Board (approval number B707201628078). Informed contentment was obtained from each subject.

Conflict of interest

The authors declare no conflicts of interest in undertaking this study.

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Tables

Table 1. *Knee measured fatigability parameters with BR_x = x^{th} best repetition; ∑[Rx:Ry] = cumulated performance from x^{th} to y^{th} repetition*

Measured parameters for knee extensors and flexors			
BR_1 extensors/flexors	*Σ[R1:R30]* extensors/flexors	*Σ[R1:R10]* extensors/flexors	*Σ[R11:R20]* extensors/flexors
Σ[R21:R30] extensors/flexors	*Σ[R1:R5]* extensors	*Σ[R6:R10]* extensors	*Σ[R11:R15]* extensors
Σ[R16:R20] extensors	*Σ[R21:R25]* extensors	*Σ[R26:R30]* extensors	

Table 2. *Summary table of inter-dynamometer compatibility for short concentric and eccentric strength and fatigability resistance evaluation protocol for each pair of dynamometers analysed (√ = use without transposition formula; f = use with transposition formula; !√ = use without transposition formula at the users' discretion; !f = use with transposition formula at the users' discretion; X = cannot be compared)*

	Biodex and ConTrex				Biodex and Cybex				ConTrex and Cybex			
	Extensors		Flexors		Extensors		Flexors		Extensors		Flexors	
	PM	MW	PM	MW	PM	MW	PM	MW	PM	MW	PM	MW
Short concentric and eccentric strength evaluation protocol												
Concentric 60°/s	√	*f*	!*f*	*f*	√	√	X	!√	√	*f*	*f*	!*f*
Concentric 240°/s	*f*	*f*	X	*f*	*f*	*f*	X	X	*f*	!*f*	!*f*	X
Eccentric 30°/s	X	X	*f*	*f*	X	X	*f*	!*f*	X	X	*f*	*f*
Ratios												
Conventional 60°/s ratio	X				X				!*f*			
Conventional 240°/s ratio	X				X				X			
DCR	X				!*f*				√			
Fatigability resistance evaluation protocol												
BR_1	√	*f*	√	*f*	*f*	*f*	X	X	*f*	*f*	X	X
∑[R1:R30]	√	√	!	!	*f*	!*f*	!	X	*f*	!*f*	X	X
∑[R1:R10]	√	!*f*	!	!	*f*	*f*	X	X	*f*	!*f*	X	X
∑[R11:R20]	√	√	!	X	*f*	!f	X	X	*f*	X	X	X
∑[R21:R30]	X	X	X	X	X	X	X	X	*f*	X	X	X
∑[R1:R5]	!*f*	X			√	*f*			*f*	!*f*		
∑[R6:R10]	√	√			*f*	*f*			*f*	!*f*		
∑[R11:R15]	√	√			*f*	!*f*			*f*	X		
∑[R16:R20]	!√	!√			!*f*	X			!*f*	X		
∑[R21:R25]	!√	!√			X	X			!*f*	X		
∑[R26:R30]	X	X			X	X			*f*	!*f*		

Table 3. *Knee extensors and flexors (PM and MW) Pearson's r [CI 95%], SEM and MBI – Chances of (dis)similarity between dynamometers for the strength profile*

	Peak torque			Maximal work		
	Pearson's r [CI 95%]	SEM	MBI - chances of (dis)similarity	Pearson's r [CI 95%]	SEM	MBI - chances of (dis)similarity
Biodex vs ConTrex						
Extensors at 60°/s concentric	0.792 [0.515/0.919] *p-value < 0.001*	7.38% √	*5/**78**/17:* similar *(likely)*	0.888 [0.72/0.958] *p-value < 0.001*	5.76% √	*0/32/**68**:* ConTrex higher *(possible)*
Extensors at 240°/s concentric	0.867 [0.672/0.950] *p-value < 0.001*	5.05% √	*0/7/**93**:* ConTrex higher *(likely)*	0.881 [0.704/0.955] *p-value < 0.001*	*4.81%* √	*0/0/**100**:* ConTrex higher *(almost certain)*
Extensors at 30°/s eccentric	0.552 [0.114/0.810] *p-value = 0.02*	11.53% X	***89**/11/0:* Biodex higher *(likely)*	*0.473* [0.008/0.77] *p-value = 0.053*	12.21% X	***80**/19/1:* Biodex higher *(likely)*
Flexors at 60°/s concentric	0.727 [0.394/0.891] *p-value = 0.001*	8.72% X	*0/31/**68**:* ConTrex higher *(possible)*	0.819 [0.571/0.93] *p-value < 0.001*	7.43% √	*0/7/**93**:* ConTrex higher *(likely)*
Flexors at 240°/s concentric	0.671 [0.298/0.867] *p-value = 0.003*	12.66% X	*0/16/**83**:* ConTrex higher *(likely)*	*0.794* [0.52/0.92] *p-value < 0.001*	11.08% X	*0/1/**99**:* ConTrex higher [very *likely)*
Flexors at 30°/s eccentric	0.866 [0.670/0.949] *p-value < 0.001*	6.52% √	***100**/0/0:* Biodex higher *(almost certain)*	0.816 [0.565/0.929] *p-value < 0.001*	7.34% √	***100**/0/0:* Biodex higher *(almost certain)*
Conventional 60°/s ratio	0.443 [-0.03/0.754] *p-value = 0.073*	10.08% X	*2/33/**65**:* ConTrex higher *(possible)*			
Conventional 240°/s ratio	0.239 [−0.257/0.635] *p-value = 0.354*	13.24% X	*7/44/**49**:* unclear			
DCR	0.592 [0.173/0.83] *p-value = 0.011*	9.35% X	***100**/0/0:* Biodex higher *(almost certain)*			
Biodex vs Cybex						
Extensors at 60°/s concentric	0.888 [0.719/0.958] *p-value < 0.001*	5.89% √	*35/**64**/1:* similar *(possible)*	0.924 [0.804/0.972] *p-value < 0.001*	4.78% √	11/***84***/5: unclear
Extensors at 240°/s concentric	0.864 [0.667/0.949] *p-value < 0.001*	4.74% √	*0/29/**71**:* Biodex higher *(possible)*	0.785 [0.503/0.916] *p-value < 0.001*	5.80% √	*0/0/**100**:* Biodex higher *(almost certain)*
Extensors at 30°/s eccentric	0.434 [−0.041/0.749] *p-value = 0.079*	10.20% X	*1/16/**83**:* Biodex higher *(likely)*	*0.552* [0.115/0.81] *p-value = 0.02*	9.23% X	*1/15/**84**:* Biodex higher *(likely)*
Flexors at 60°/s concentric	0.637 [0.242/0.851] *p-value = 0.005*	9.29% X	*21/**61**/17:* unclear	*0.716* [0.374/0.887] *p-value = 0.001*	8.45% X	*18/**69**/13:* unclear
Flexors at 240°/s concentric	0.645 [0.254/0.854] *p-value = 0.005*	9.83% X	*0/1/**92**:* Biodex higher *(likely)*	0.51 [0.057/0.789] *p-value = 0.035*	12.04% X	*0/0/**100**:* Biodex higher *(almost certain)*
Flexors at 30°/s eccentric	0.849 [0.633/0.942] *p-value < 0.001*	6.66% √	*0/0/**100**:* Biodex higher *(almost certain)*	*0.735* [0.408/0.895] *p-value = 0.001*	8.26% √	*0/0/**100**:* Biodex higher *(almost certain)*
Conventional 60°/s ratio	0.384 [−0.101/0.722] *p-value = 0.125*	10.34% X	*18/46/36:* unclear			
Conventional 240°/s ratio	0.503 [0.047/0.785] *p-value = 0.038*	8.86% X	1/22/77: Biodex higher *(likely)*			
DCR	*0.776* [0.484/0.912] *p-value < 0.001*	7.05% √	*0/0/**100**:* Biodex higher *(almost certain)*			

Table 3, continued

	Peak torque			Maximal work		
	Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity	Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity
			ConTrex vs Cybex			
Extensors at 60°/s concentric	0.834 [0.602/0.936] *p-value < 0.001*	7.07% √	4/***81***/16: similar *(likely)*	0.842 [0.618/0.939] *p-value < 0.001*	6.49% √	***63***/37/0: ConTrex higher *(possible)*
Extensors at 240°/s concentric	0.87 [0.678/0.951] *p-value < 0.001*	5.05% √	***100***/0/0: ConTrex higher *(almost certain)*	0.724 [0.389/0.89] *p-value = 0.001*	7.32% √	***100***/0/0: ConTrex higher *(almost certain)*
Extensors at 30°/s eccentric	0.494 [0.035/0.781] *p-value = 0.042*	12.71% X	10/41/***49***: unclear	0.61 [0.201/0.838] *p-value = 0.008*	11.02% X	14/***52***/34: unclear
Flexors at 60°/s concentric	0.800 [0.531/0.922] *p-value < 0.001*	7.74% √	***72***/28/0: ConTrex higher *(possible)*	0.752 [0.439/0.902] *p-value < 0.001*	8.64% X	***91***/9/0: ConTrex higher *(likely)*
Flexors at 240° /s concentric	0.748 [0.431/0.900] *p-value < 0.001*	12.28% X	***100***/0/0: ConTrex higher *(almost certain)*	0.685 [0.321/0.873] *p-value = 0.002*	14.44% X	***100***/0/0: ConTrex higher *(almost certain)*
Flexors at 30°/s eccentric	0.900 [0.746/0.962] *p-value < 0.001*	6.27% √	98/2/0: ConTrex higher *(very likely)*	0.788 [0.508/0.917] *p-value<0.001*	8.53% √	***99***/1/0: ConTrex higher *(almost certain)*
Conventional 60°/s ratio	0.747 [0.43/0.900] *p-value < 0.001*	7.50% X	***84***/16/0: ConTrex higher *(likely)*			
Conventional 240°/s ratio	0.537 [0.094/0.803] *p-value = 0.025*	10.68% X	***94***/5/0: ConTrex higher *(likely)*			
DCR	0.812 [0.555/0.927] *p-value < 0.001*	7.17% √	7/***80***/12: unclear			

Table 4. *Knee extensors (PM and MW) Pearson's r [CI 95%], SEM and MBI – Chances of (dis)similarity between dynamometers for the fatigability protocol*

		Peak torque			Maximal work		
		Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity	Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity
				Biodex vs ConTrex			
Extensors	*BR_1*	0.826 [0.584/0.933] *p-value < 0.001*	5.71% √	2/**72**/26: similar *(possible)*	0.808 [0.548/0.926] *p-value < 0.001*	5.93% √	0/18/**82**: ConTrex higher *(likely)*
	∑[R1:R30]	0.823 [0.579/0.932] *p-value < 0.001*	5.53% √	6/**83**/11: unclear	0.812 [0.555/0.927] *p-value < 0.001*	5.70% √	3/**77**/20: similar *(likely)*
	∑[R1:R10]	0.807 [0.546/0.925] *p-value < 0.001*	6.08% √	5/**80**/15: unclear	0.758 [0.451/0.905] *p-value < 0.001*	6.96% X	1/46/**53**: ConTrex higher *(possible)*
	∑[R11:R20]	0.792 [0.516/0.919] *p-value < 0.001*	6.05% √	11/**80**/8: unclear	0.835 [0.603/0.937] *p-value < 0.001*	5.63% √	12/**83**/4: similar *(likely)*
	∑[R21:R30]	0.675 [0.305/0.868] *p-value = 0.002*	7.41% X	11/**72**/17: unclear	0.66 [0.279/0.861] *p-value = 0.002*	6.95% X	19/**70**/12: unclear
	∑[R1:R5]	0.754 [0.443/0.903] *p-value < 0.001*	6.98% *X*	1/41/**58**: ConTrex higher *(possible)*	0.697 [0.342/0.878] *p-value = 0.001*	7.71% X	0/12/**88**: ConTrex higher *(likely)*
	∑[R6:R10]	0.836 [0.605/0.937] *p-value < 0.001*	5.71% √	39/**60**/1: similar *(possible)*	0.792 [0.515/0.919] *p-value < 0.001*	6.80% X	10/**80**/10: unclear
	∑[R11:R15]	0.829 [0.592/0.934] *p-value < 0.001*	5.64% √	8/**84**/8: unclear	0.829 [0.592/0.934] *p-value < 0.001*	5.64% √	6/**90**/4: similar *(likely)*
	∑[R16:R20]	0.725 [0.390/0.890] *p-value = 0.001*	6.89% X	16/**74**/10: unclear	0.741 [0.419/0.897] *p-value < 0.001*	6.59% X	22/**72**/6: unclear
	∑[R21:R25]	0.747 [0.431/0.900] *p-value < 0.001*	6.62% X	7/**76**/17: unclear	0.762 [0.459/0.907] *p-value < 0.001*	6.13% X	18/**76**/6: unclear
	∑[R26:R30]	0.572 [0.144/0.820] *p-value = 0.012*	8.90% X	17/**66**/17: unclear	0.472 [0.007/0.769] *p-value < 0.046*	9.06% X	21/**60**/19: unclear
				Biodex vs Cybex			
Extensors	*BR_1*	0.843 [0.619/0.940] *p-value < 0.001*	5.51% √	1/43/**56**: Biodex higher *(possible)*	0.833 [0.600/0.936] *p-value < 0.001*	5.01% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R1:R30]	0.791 [0.514/0.919] *p-value < 0.001*	6.04% √	0/16/**84**: Biodex higher *(likely)*	0.739 [0.416/0.897] *p-value < 0.001*	5.69% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R1:R10]	0.845 [0.624/0.941] *p-value < 0.001*	5.44% √	0/25/**75**: Biodex higher *(possible)*	0.833 [0.598/0.936] *p-value < 0.001*	4.88% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R11:R20]	0.779 [0.491/0.914] *p-value < 0.001*	6.43% √	0/10/**90**: Biodex higher *(likely)*	0.725 [0.390/0.890] *p-value = 0.001*	6.46% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R21:R30]	0.584 [0.161/0.826] *p-value = 0.01*	8.75% X	3/28/**69**: Biodex higher *(possible)*	0.436 [−0.039/0.750] *p-value = 0.068*	8.88% X	0/1/**99**: Biodex higher *(almost certain)*
	∑[R1:R5]	0.845 [0.625/0.941] *p-value < 0.001*	5.43% √	3/**72**/25: similar *(possible)*	0.835 [0.602/0.937] *p-value < 0.001*	4.95% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R6:R10]	0.816 [0.563/0.929] *p-value < 0.001*	5.98% √	0/4/**96**: Biodex higher *(very likely)*	0.797 [0.526/0.921] *p-value < 0.001*	5.51% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R11:R15]	0.795 [0.522/0.920] *p-value < 0.001*	6.21% √	0/7/**93**: Biodex higher *(likely)*	0.743 [0.422/0.898] *p-value < 0.001*	6.56% √	0/0/**100**: Biodex higher *(almost certain)*
	∑[R16:R20]	0.730 [0.399/0.893] *p-value < 0.001*	7.15% X	0/15/**85**: Biodex higher *(likely)*	0.644 [0.254/0.854] *p-value = 0.003*	7.14% X	0/0/**100**: Biodex higher *(almost certain)*

Table 4, continued

		Peak torque			Maximal work		
		Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity	Pearson's r [CI 95%]	SEM	MBI – chances of (dis)similarity
	∑[R21:R25]	0.675 [0.304/0.868] *p-value = 0.002*	7.70% X	3/31/**<u>66</u>**: Biodex higher *(possible)*	0.534 [0.089/0.801] *p-value = 0.021*	8.00% X	0/0/**<u>100</u>**: Biodex higher *(almost certain)*
	∑[R26:R30]	0.420 [-0.058/0.741] *p-value = 0.081*	10.91% X	4/27/**<u>69</u>**: Biodex higher *(possible)*	0.266 [-0.229/0.652] *p-value = 0.283*	10.95% X	0/2/**<u>98</u>**: Biodex higher *(very likely)*
				ConTrex vs Cybex			
Extensors	*BR_1*	0.894 [0.734/0.960] *p-value < 0.001*	4.71% √	**<u>78</u>**/22/0: ConTrex higher *(likely)*	0.815 [0.561/0.928] *p-value < 0.001*	6.08% √	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R1:R30]	0.861 [0.659/0.947] *p-value < 0.001*	5.24% √	**<u>83</u>**/17/0: ConTrex higher *(likely)*	0.747 [0.430/0.900] *p-value < 0.001*	6.80% √	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R1:R10]	0.874 [0.688/0.952] *p-value < 0.001*	5.19% √	**<u>77</u>**/23/0: ConTrex higher *(likely)*	0.768 [0.469/0.909] *p-value < 0.001*	7.15% √	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R11:R20]	0.795 [0.521/0.920] *p-value < 0.001*	6.51% √	**<u>85</u>**/15/0: ConTrex higher *(likely)*	0.686 [0.323/0.873] *p-value = 0.001*	7.97% X	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R21:R30]	0.800 [0.532/0.922] *p-value < 0.001*	6.62% √	**<u>68</u>**/31/0: ConTrex higher *(possible)*	0.681 [0.314/0.871] *p-value = 0.002*	7.29% X	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R1:R5]	0.873 [0.686/0.952] *p-value < 0.001*	5.27% √	**<u>85</u>**/15/0: ConTrex higher *(likely)*	0.752 [0.439/0.902] *p-value < 0.001*	7.37% √	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*
	∑[R6:R10]	0.866 [0.671/0.949] *p-value < 0.001*	5.46% √	**<u>63</u>**/37/0: ConTrex higher *(possible)*	0.780 [0.492/0.914] *p-value < 0.001*	7.27% √	**<u>100</u>**/0/0: ConTrex higher *(almost certain)*

Table 5. *Coefficients and constants of transposition formulas for strength profile with using advices (√ = use without transposition formula; f = use with transposition formula; !√ = use without transposition formula at the users' discretion; ! = use with transposition formula at the users' discretion; X = can't be compared) and r^2 of the linear regression between pooled data and MBI – Chances of (dis)similarity between transposed data by formulas and measured data (f = transposition formulas)*

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition *f*	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From Biodex to ConTrex			Concordance	From ConTrex to Biodex		
						Extensors			
PM	Concentric 60°/s	√	0.950 [0.868/1.032] *p-value < 0.001*	12.564 [0.919/24.213] *p-value = 0.035*	12/**80**/8: unclear	0.884 *p-value < 0.001*	0/28/**71**: *f* under-estimates *(possible)*	0.930 [0.850/1.011] *p-value < 0.001*	3.937 [−7.923/15.801] *p-value = 0.510*
	Concentric 240°/s	*f*			2/**82**/15: similar values *(likely)*		24/**74**/2: similar values *(possible)*		
	Eccentric 30°/s	X	1.067 [0.912/1.216] *p-value < 0.001*	−31.209 [−65.897/3.457] *p-value = 0.076*	**57**/41/2: *f* over-estimates *(possible)*	0.885 *p-value < 0.001*	1/12/**87**: *f* under-estimates *(likely)*	0.829 [0.714/0.945] *p-value < 0.001*	51.836 [26.421/77.252] *p-value < 0.001*
MW	Concentric 60°/s	*f*	0.999 [0.930/1.069] *p-value < 0.001*	9.884 [−2.611/22.407] *p-value = 0.119*	4/**89**/8: similar values *(likely)*	0.921 *p-value < 0.001*	1/**52**/47: similar values *(possible)*	0.922 [0.858/0.986] *p-value < 0.001*	4.270 [−7.919/16.446] *p-value = 0.4875*
	Concentric 240°/s	*f*			0/6/**94**: *f* under-estimates *(likely)*		**97**/3/0: *f* over-estimates *(very likely)*		
	Eccentric 30°/s	X	0.926 [0.760/1.092] *p-value < 0.001*	−6.350 [−55.488/42.742] *p-value = 0.793*	7/**56**/37: unclear	0.818 *p-value < 0.001*	14/**49**/37: unclear	0.883 [0.725/1.042] *p-value < 0.001*	57.977 [15.312/100.678] *p-value = 0.010*
						Flexors			
PM	Concentric 60°/s	!	0.950 [0.868/1.032] *p-value < 0.001*	12.564 [0.919/24.213] *p-value = 0.035*	15/**75**/9: unclear	0.884 *p-value < 0.001*	27/**63**/10: unclear	0.930 [0.850/1.011] *p-value < 0.001*	3.937 [−7.923/15.801] *p-value = 0.510*
	Concentric 240°/s	X			14/**72**/13: unclear		**76**/23/2: *f* over-estimates *(likely)*		
	Eccentric 30°/s	*f*	1.067 [0.912/1.216] *p-value < 0.001*	−31.209 [−65.897/3.457] *p-value = 0.076*	17/**81**/2: similar values *(likely)*	0.885 *p-value < 0.001*	21/**78**/1: similar values *(likely)*	0.829 [0.714/0.945] *p-value < 0.001*	51.836 [26.421/77.252] *p-value < 0.001*
MW	Concentric 60°/s	*f*	0.999 [0.930/1.069] *p-value < 0.001*	9.884 [-2.611/22.407] *p-value = 0.119*	3/**78**/19: similar values *(likely)*	0.921 *p-value < 0.001*	35/**63**/3: similar values *(possible)*	0.922 [0.858/0.986] *p-value < 0.001*	4.270 [−7.919/16.446] *p-value = 0.4875*
	Concentric 240°/s	*f*			1/41/**58**: *f* under-estimates *(possible)*		**96**/4/0: *f* over-estimates *(very likely)*		
	Eccentric 30°/s	*f*	0.926 [0.760/1.092] *p-value < 0.001*	−6.350 [−55.488/42.742] *p-value = 0.793*	11/**82**/6: unclear	0.818 *p-value < 0.001*	**61**/39/0: *f over-*estimates *(possible)*	0.883 [0.725/1.042] *p-value < 0.001*	57.977 [15.312/100.678] *p-value = 0.010*
						Ratios			
Concentric 60°/s		X	0,675 [0.591/0.759] *p-value < 0.001*	0.233 [0.152/0.313] *p-value < 0.001*	36/**57**/8: unclear	0.836 *p-value < 0.001*	**76**/20/4: *f* over-estimates *(likely)*	1.238 [1.083/1.392] *p-value < 0.001*	−0.144 [−0.278/−0.010] *p-value = 0.036*
Concentric 240°/s		X			19/**59**/23: unclear		**74**/20/6: unclear		
DCR		X			19/**68**/13: unclear		1/12/**87**: *f* under-estimates *(likely)*		

Table 5, continued

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition *f*	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From Biodex to Cybex			Concordance		From Cybex to Biodex	
						Extensors			
PM	Concentric 60°/s	√	1.062 [0.991/1.131] *p-value < 0.001*	−10.096 [−20.242/0.051] *p-value = 0.051*	**<u>79</u>**/7/14: unclear	0.926 *p-value < 0.001*	1/**<u>72</u>**/27: similar values (possible)	0.872 [0.813/0.931] *p-value < 0.001*	18.742 [10.418/27.066] *p-value < 0.001*
	Concentric 240°/s	*f*			30/**<u>69</u>**/1: similar values *(possible)*		1/**<u>72</u>**/27: similar values (possible)		
	Eccentric 30°/s	X	1.176 [1.020/1.332] *p-value < 0.001*	−61.008 [−98.087/−23.929] *p-value = 0.002*	**<u>48</u>**/44/8: unclear	0.884 *p-value < 0.001*	2/25/**<u>74</u>**: *f* under-estimates (possible)	0.752 [0.652/0.851] *p-value < 0.001*	72.531 [50.360/94.703] *p-value < 0.001*
MW	Concentric 60°/s	√	1.084 [1.010/1.158] *p-value < 0.001*	−23.344 [−36.657/−10.032] *p-value < 0.001*	1/**<u>90</u>**/9: similar values *(likely)*	0.924 *p-value < 0.001*	0/**<u>72</u>**/28: similar values (possible)	0.852 [0.794/0.910] *p-value < 0.001*	32.815 [22.693/42.936] *p-value < 0.001*
	Concentric 240°/s	*f*			**<u>96</u>**/4/0: *f* over-estimates *(very likely)*		0/10/**<u>90</u>**: *f* under-estimates (likely)		
	Eccentric 30°/s	X	1.057 [0.913/1.201] *p-value < 0.001*	−53.033 [−96.319/−9.746] *p-value = 0.018*	3/36/**<u>61</u>**: *f* under-estimates *(possible)*	0.878 *p-value < 0.001*	25/**<u>63</u>**/12: unclear	0.831 [0.717/0.944] *p-value < 0.001*	79.631 [49.331/109.931] *p-value < 0.001*
						Flexors			
PM	Concentric 60°/s	X	1.062 [0.991/1.131] *p-value < 0.001*	−10.096 [−20.242/0.051] *p-value = 0.051*	4/**<u>55</u>**/41: similar values *(possible)*	0.926 *p-value < 0.001*	**<u>55</u>**/42/3: *f* over-estimates *(possible)*	0.872 [0.813/0.931] *p-value < 0.001*	18.742 [10.418/27.066] *p-value < 0.001*
	Concentric 240°/s	X			**<u>49</u>**/45/6: unclear		31/**<u>63</u>**/6: unclear		
	Eccentric 30°/s	*f*	1.176 [1.020/1.332] *p-value < 0.001*	−61.008 [−98.087/−23.929] *p-value = 0.002*	**<u>50</u>**/49/1: *f* over-estimates *(possible)*	0.884 *p-value < 0.001*	13/**<u>83</u>**/4: similar values *(likely)*	0.752 [0.652/0.851] *p-value < 0.001*	72.531 [50.360/94.703] *p-value < 0.001*
MW	Concentric 60°/s	!√	1.084 [1.010/1.158] *p-value < 0.001*	−23.344 [−36.657/−10.032] *p-value < 0.001*	0/11/**<u>89</u>**: *f* under-estimates *(likely)*	0.924 *p-value < 0.001*	**<u>91</u>**/9/0: *f* over-estimates *(likely)*	0.852 [0.794/0.910] *p-value < 0.001*	32.815 [22.693/42.936] *p-value < 0.001*
	Concentric 240°/s	X			**<u>61</u>**/33/6: unclear		28/**<u>62</u>**/10: unclear		
	Eccentric 30°/s	!	1.057 [0.913/1.201] *p-value < 0.001*	−53.033 [−96.319/−9.746] *p-value = 0.018*	**<u>50</u>**/47/4: *f* over-estimates *(possible)*	0.878 *p-value < 0.001*	19/**<u>74</u>**/7: unclear	0.831 [0.717/0.944] *p-value < 0.001*	79.631 [49.331/109.931] *p-value < 0.001*
						Ratios			
Concentric 60°/s		X	0.752 [0.696/0.809] *p-value < 0.001*	0.140 [0.086/0.195] *p-value < 0.001*	16/**<u>61</u>**/23: unclear	0.933 *p-value < 0.001*	**<u>62</u>**/30/8: unclear	1.240 [1.147/1.334] *p-value < 0.001*	-0.116 [-0.195/-0.036] *p-value = 0.005*
Concentric 240°/s		X			37/**<u>55</u>**/8: unclear		27/**<u>55</u>**/18: unclear		
DCR		!			21/**<u>74</u>**/4: similar values *(possible)*		1/32/**<u>67</u>**: *f* under-estimates *(possible)*		

Table 5, continued

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition *ƒ*	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From ConTrex to Cybex			Concordance	From Cybex to ConTrex		
						Extensors			
PM	Concentric 60°/s	√	1.035 [0.952/1.118] *p-value < 0.001*	–12.477 [–24.759/–0.192] *p-value = 0.047*	0/46/**54**: *ƒ* under-estimates(possible)	0.898 *p-value < 0.001*	8/**84**/7: unclear	0.867 [0.798/0.937] *p-value < 0.001*	25.164 [15.275/35.060] *p-value < 0.001*
	Concentric 240°/s	*ƒ*			**58**/42/0: *ƒ* over-estimates (possible)		0/**58**/42: similar values (possible)		
	Eccentric 30°/s	X	1.040 [0.912/1.169] *p-value < 0.001*	–12.991 [-41.723/15.764] *p-value = 0.364*	8/36/**56**: unclear	0.898 *p-value < 0.001*	24/**63**/12: unclear	0.863 [0.757/0.970] *p-value < 0.001*	32.986 [9.361/56.609] *p-value = 0.008*
MW	Concentric 60°/s	*ƒ*	1.022 [0.937/1.108] *p-value < 0.001*	-22.784 [–39.017/–6.573] *p-value = 0.007*	1/**56**/43: similar values (possible)	0.890 *p-value < 0.001*	2/**79**/18: similar values (likely)	0.871 [0.798/0.944] *p-value < 0.001*	39.577 [26.923/52.250] *p-value < 0.001*
	Concentric 240°/s	!			**100**/0/0: *ƒ* over-estimates (almost certain)		0/0/**100**: f under-estimates (almost certain)		
	Eccentric 30°/s	X	0.997 [0.844/1.150] *p-value < 0.001*	–7.601 [–50.042/34.896] *p-value = 0.719*	4/35/**61**: *ƒ* under-estimates (possible)	0.846 *p-value < 0.001*	18/**69**/13: unclear	0.849 [0.718/0.979] *p-value < 0.001*	47,491 [12.125/82.807] *p-value = 0.010*
						Flexors			
PM	Concentric 60°/s	*ƒ*	1.035 [0.952/1.118] *p-value < 0.001*	–12.477 [–24.759/–0.192] *p-value = 0.047*	4/**64**/32: similar values (possible)	0.898 *p-value < 0.001*	41/**58**/1: similar values (possible)	0.867 [0.798/0.937] *p-value < 0.001*	25.164 [15.275/35.060] *p-value < 0.001*
	Concentric 240°/s	!			**83**/15/2: *ƒ* over-estimates (likely)		10/**74**/16: unclear		
	Eccentric 30°/s	*ƒ*	1.040 [0.912/1.169] *p-value < 0.001*	–12.991 [–41.723/15.764] *p-value = 0.364*	**60**/39/0: *ƒ* over-estimates (possible)	0.898 *p-value < 0.001*	4/**91**/5: similar values (likely)	0.863 [0.757/0.970] *p-value < 0.001*	32.986 [9.361/56.609] *p-value = 0.008*
MW	Concentric 60°/s	!	1.022 [0.937/1.108] *p-value < 0.001*	–22.784 [–39.017/–6.573] *p-value = 0.007*	1/28/**71**: *ƒ* under-estimates (possible)		**69**/31/0: f over-estimates (possible)	0.871 [0.798/0.944] *p-value < 0.001*	39.577 [26.923/52.250] *p-value < 0.001*
	Concentric 240°/s	X			**98**/2/0: *ƒ* over-estimates (very likely)	0.890 *p-value < 0.001*	2/42/**57**: f under-estimates (possible)		
	Eccentric 30°/s	*ƒ*	0.997 [0.844/1.150] *p-value < 0.001*	–7.601 [–50.042/34.896] *p-value = 0.719*	**87**/13/0: *ƒ* over-estimates (likely)	0.846 *p-value < 0.001*	6/**77**/17: unclear	0.849 [0.718/0.979] *p-value < 0.001*	47,491 [12.125/82.807] *p-value = 0.010*
						Ratios			
Concentric 60°/s		!	0.997 [0.890/1.094] *p-value < 0.001*	–0.024 [–0.108/0.060] *p-value = 0.566*	24/**69**/7: unclear	0.891 *p-value < 0.001*	43/**55**/2: similar values (possible)	0.894 [0.807/0.981] *p-value < 0.001*	0.111 [0.037/0.185] *p-value = 0.004*
Concentric 240°/ s		X			**69**/27/5: *ƒ* over-estimates (possible)		10/**64**/26: unclear		
DCR		√			1/**56**/43: similar values (possible)		5/**80**/14: unclear		

Table 6. *Coefficients and constants of transposition formulas for fatigability protocol with using advices (√ = use without transposition formula; ƒ = use with transposition formula; !√ = use without transposition formula at the users' discretion; ! = use with transposition formula at the users' discretion; X = cannot be compared) and r^2 of the linear regression between pooled data and MBI –Chances of (dis)similarity between transposed data by formulas and measured data (ƒ = transposition formulas)*

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition f	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From Biodex to ConTrex			Concordance	From ConTrex to Biodex		
						Extensors			
PM	*BR_1*	√	0.994 [0.909/1.080] *p-value < 0.001*	5.052 [−46.119/56.204] *p-value = 0.846*		0.834 *p-value < 0.001*		0.839 [0.767/0.911] *p-value < 0.001*	92.941 [49.488/136.414] *p-value < 0.001*
	∑[R1:R30]	√			4/**<u>81</u>**/15: similar values *(likely)*		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R1:R10]	√			4/**<u>79</u>**/17: similar values *(likely)*		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R11:R20]	√			10/**<u>81</u>**/9: unclear		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R21:R30]	X			11/**<u>72</u>**/17: unclear		0/6/**<u>94</u>**: *ƒ* under-estimates *(likely)*		
	∑[R1:R5]	!			1/43/**<u>56</u>**: *ƒ* under-estimates *(possible)*		11/**<u>73</u>**/16: unclear		
	∑[R6:R10]	√			42/**<u>57</u>**/1: similar values *(possible)*		0/6/**<u>94</u>**: *ƒ* under-estimates *(likely)*		
	∑[R11:R15]	√			10/**<u>84</u>**/6: unclear		2/**<u>72</u>**/26: similar values *(possible)*		
	∑[R16:R20]	!√			19/**<u>73</u>**/8: unclear		16/**<u>73</u>**/11: unclear		
	∑[R21:R25]	!√			10/**<u>77</u>**/13: unclear		**<u>76</u>**/23/0: *ƒ* over-estimates *(likely)*		
	∑[R26:R30]	X			22/**<u>65</u>**/13: unclear		**<u>89</u>**/11/0: *ƒ* over-estimates *(likely)*		
MW	*BR_1*	*ƒ*	1.061 [0.974/1.147] *p-value < 0.001*	−36.739 [−101.114/27.650] *p-value = 0.261*		0.848 *p-value < 0.001*		0.800 [0.735/0.865] *p-value < 0.001*	139.662 [90.259/189.068] *p-value < 0.001*
	∑[R1:R30]	√			**<u>78</u>**/22/0: *ƒ* over-estimates *(likely)*		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R1:R10]	!			18/**<u>76</u>**/6: unclear		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R11:R20]	√			**<u>76</u>**/24/0: *ƒ* over-estimates *(likely)*		0/0/**<u>100</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R21:R30]	X			**<u>60</u>**/38/1: *ƒ* over-estimates *(possible)*		0/1/**<u>99</u>**: *ƒ* under-estimates *(almost certain)*		
	∑[R1:R5]	X			1/32/**<u>67</u>**: *ƒ* under-estimates *(possible)*		22/**<u>66</u>**/12: unclear		
	∑[R6:R10]	√			31/**<u>67</u>**/2: similar values *(possible)*		0/12/**<u>88</u>**: *ƒ* under-estimates *(likely)*		
	∑[R11:R15]	√			21/**<u>78</u>**/1: similar values *(likely)*		0/**<u>50</u>**/50: similar values *(possible)*		

Table 6, continued

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition f	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From Biodex to ConTrex			Concordance	From ConTrex to Biodex		
	∑[R16:R20]	!√			34/**63**/3: similar values *(possible)*		8/**72**/20: unclear		
	∑[R21:R25]	!√			16/**76**/7: unclear		**68**/32/0: *f* overestimates *(possible)*		
	∑[R26:R30]	X			12/**56**/31: unclear		**96**/4/0: *f* overestimates *(very likely)*		
			From Biodex to Cybex			Concordance	From Cybex to Biodex		
						Extensors			
PM	*BR_1*	*f*	0.955 [0.869/1.040] *p-value < 0.001*	2.957 [-48.141/54.055] *p-value = 0.909*		0.823 *p-value < 0.001*		0.862 [0.785/0.939] *p-value < 0.001*	101.212 [56.731/145.693] *p-value < 0.001*
	∑[R1:R30]	*f*			7/**80**/13: unclear		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R1:R10]	*f*			3/**80**/17: similar values *(likely)*		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R11:R20]	*f*			19/**76**/5: similar values *(likely)*		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R21:R30]	X			12/**67**/22: unclear		0/8/**92**: *f* under-estimates *(likely)*		
	∑[R1:R5]	√			0/46/**54**: *f* under-estimates *(possible)*		3/**81**/16: similar values *(likely)*		
	∑[R6:R10]	*f*			26/**72**/2: similar values *(possible)*		0/12/**88**: *f* under-estimates *(likely)*		
	∑[R11:R15]	*f*			27/**71**/3: similar values *(possible)*		1/**50**/49: similar values *(possible)*		
	∑[R16:R20]	!			20/**73**/7: unclear		16/**72**/12: unclear		
	∑[R21:R25]	X			8/**70**/21: unclear		**83**/17/1: *f* over-estimates *(likely)*		
	∑[R26:R30]	X			22/**60**/18: unclear		**89**/11/1: *f* over-estimates *(likely)*		
MW	*BR_1*	*f*	0.860 [0.786/0.935] *p-value < 0.001*	22.217 [−33.449/77.882] *p-value = 0.431*		0.831 *p-value < 0.001*		0.966 [0.882/1.050] *p-value < 0.001*	101.277 [45.422/157.133] *p-value < 0.001*
	∑[R1:R30]	!			1/40/**59**: *f* under-estimates *(possible)*		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R1:R10]	*f*			0/34/**66**: *f* under-estimates *(possible)*		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R11:R20]	!			17/**73**/9: unclear		0/0/**100**: *f* under-estimates *(almost certain)*		
	∑[R21:R30]	X			7/**51**/42: unclear		2/23/**75**: *f* under-estimates *(likely)*		

Table 6, continued

		Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition f	MBI – chances of (dis)similarity	Coefficient [CI 95%]	Constant [CI 95%]
			From Biodex to Cybex			Concordance	From Cybex to Biodex		
	∑[R1:R5]	*f*			0/15/**85**: *f* under-estimates *(likely)*		14/**81**/5: similar values *(likely)*		
	∑[R6:R10]	*f*			16/**79**/5: unclear		0/20/**80**: *f* under-estimates *(likely)*		
	∑[R11:R15]	!			44/**54**/2: similar values *(possible)*		1/36/**64**: f under-estimates *(possible)*		
	∑[R16:R20]	x			43/**54**/4: similar values *(possible)*		9/**64**/27: unclear		
	∑[R21:R25]	x			19/**64**/17: unclear		**73**/25/2: *f* over-estimates *(possible)*		
	∑[R26:R30]	x			26/**54**/19: unclear		**90**/9/1: *f* over-estimates *(likely)*		
			From ConTrex to Cybex			Concordance	From Cybex to ConTrex		
						Extensors			
PM	*BR_1*	*f*	0.899 [0.831/0.968] *p-value < 0.001*	33766 [−7.369/74.917] *p-value = 0.107*		0.866 *p-value < 0.001*		0.963 [0.890/1.036] *p-value < 0.001*	46.380 [4.207/88.527] *p-value = 0.031*
	∑[R1:R30]	*f*			0/11/**89**: *f* under-estimates *(likely)*		0/2/**98**: *f* under-estimates *(very likely)*		
	∑[R1:R10]	*f*			0/28/**72**: *f* under-estimates *(possible)*		0/19/**81**: *f* under-estimates *(likely)*		
	∑[R11:R20]	*f*			1/**59**/40: similar values *(possible)*		0/18/**82**: *f* under-estimates *(likely)*		
	∑[R21:R30]	*f*			1/**57**/42: similar values *(possible)*		1/**54**/45: similar values *(possible)*		
	∑[R1:R5]	*f*			2/**82**/16: similar values *(likely)*		1/**72**/27: similar values *(possible)*		
	∑[R6:R10]	*f*			1/**74**/26: similar values *(possible)*		5/**88**/8: similar values *(likely)*		
	∑[R11:R15]	*f*			17/**78**/4: similar values *(likely)*		2/**69**/28: similar values *(possible)*		
	∑[R16:R20]	!			16/**76**/8: unclear		15/**75**/10: unclear		
	∑[R21:R25]	!			17/**75**/8: unclear		39/**58**/3: similar values *(possible)*		
	∑[R26:R30]	*f*			32/**66**/2: similar values *(possible)*		**54**/45/1: *f* over-estimates *(possible)*		
MW	*BR_1*	*f*	0.746 [0.681/0.811] *p-value < 0.001*	99.892 [50.336/149.441] *p-value < 0.001*		0.829 *p-value < 0.001*		1.111 [1.014/1.208] *p-value < 0.001*	14.882 [−49.913/79.677] *p-value = 0.650*
	∑[R1:R30]	!			0/0/**100**: *f* under-estimates *(almost certain)*		3/**64**/33: similar values *(possible)*		

Table 6, continued

	Advices	Coefficient [CI 95%]	Constant [CI 95%]	MBI – chances of (dis)similarity	r^2 of transposition f	MBI – chances of (dis)similarity	Coefficient [CI 95%]
		From ConTrex to Cybex			Concordance		From Cybex to ConTrex
Σ[R1:R10]	!			0/1/**99**: *f* under-estimates *(almost certain)*		2/**62**/36: similar values*(possible)*	
Σ[R11:R20]	X			0/3/**97**: *f* under-estimates *(very likely)*		5/**63**/32: similar values*(possible)*	
Σ[R21:R30]	X			0/3/**97**: *f* under-estimates *(very likely)*		35/**60**/6: unclear	
Σ[R1:R5]	!			2/**53**/45: similar values *(possible)*		3/**64**/33: similar values *(possible)*	
Σ[R6:R10]	!			2/**56**/42: similar values *(possible)*		7/**78**/15: unclear	
Σ[R11:R15]	X			18/**69**/13: unclear		6/**67**/27: unclear	
Σ[R16:R20]	X			27/**64**/9: unclear		19/**68**/14: unclear	
Σ[R21:R25]	X			34/**58**/8: unclear		**52**/44/4: *f* over-estimates *(possible)*	
Σ[R26:R30]	!			**79**/21/0: *f* over-estimates *(likely)*		**55**/43/2: *f* over-estimates *(possible)*	

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