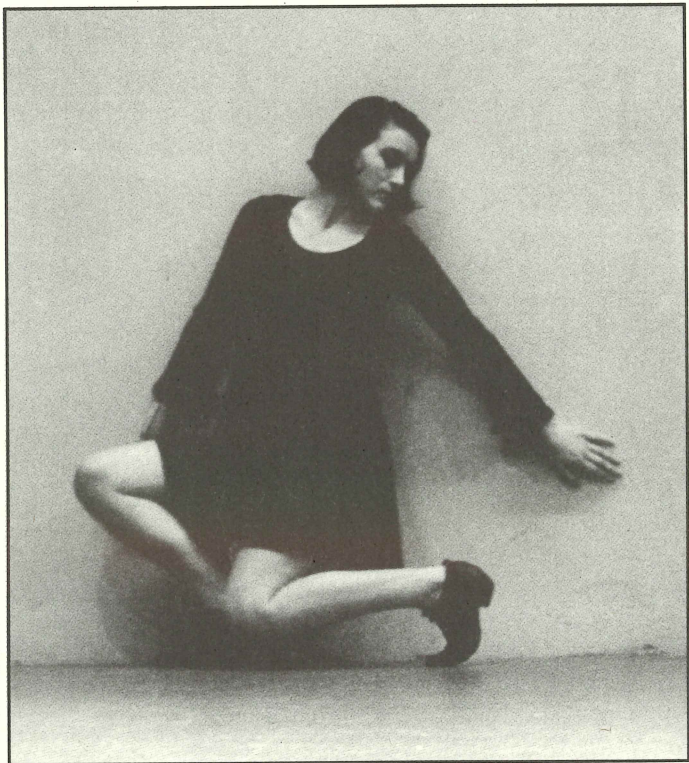


... the first mark of the potential choreographer is a knowledge of, or at least a great curiosity about, the body - not just his own, but the heterogeneous mixture of bodies with people in his environment.

Doris Humphrey, 1959



COMPARISON OF FLEXIBILITY TRAINING METHODS IN FEMALE DANCERS

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Introduction

Since various methods of flexibility training were applied and tested in different sport disciplines and rehabilitation programmes, a growing controversy has arisen as to which method preference should be given.

In our opinion, discrepancies between the conclusions of these investigations are mainly due to a misunderstanding in the methodology. The distinction between static versus dynamic work and active versus passive character of movement, as made in existing classifications of methods (6), is related to the manner in which exercises are carried out, which is only a minor aspect of the whole procedure.

What really counts is what happens within the muscle or muscle group being stretched. Therefore, we propose to classify muscle stretching procedures as indirect and direct.

In the indirect method, the muscle is stretched by external forces (forces external to the muscle, not to the subject). Hereby the muscle must remain passive, as relaxed as possible and is thus stretched passively.

In the direct method the muscle contracts eccentrically and controls the movement; the stretching is thus active. Muscle-physiologists use the terms 'passive lengthening' and 'active lengthening', which express perfectly the action in the muscle.

With this distinction in mind, we compare four methods: two indirect ones, a direct one and a combination of both. This is done on the adductor muscles of the lower extremities, for reasons explained elsewhere (12). As subjects we have chosen women taking a jazz-dance course because these women are highly enthusiastic for flexibility training and anxious to discover the 'best' technique.

Method

192 females took part in the flexibility training programme, which was included in a weekly dance course, for a period of seven weeks. According to their

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technical level the experimental group was divided into seven subgroups, as illustrated in table 1, and each submitted to one of the four following training programmes :

two indirect techniques :

1. slow passive stretching and static stretching of the adductor muscles : PASS
2. stretching the adductor muscles by concentric contraction (in a proximal range) of the hip abductors : CONC.ABD

the direct technique :

3. eccentric contraction of the adductor muscles (in an extreme distant range) : ECC.ADD

a combined technique :

4. a modified PNF-technique with alternate resisted contracting of adductor and abductor muscles, combined with eccentric contractions of the adductors

Since in a previous study on adductor flexibility (12), we found that the results of training were not linked to initial flexibility, the subjects of the subgroups have not been matched for this factor.

A control group consisted of young women, also taking part in the dance courses.

The training sessions took 15 minutes and were preceded by standardised warm up exercises, avoiding stretching of the adductors. In all methods it was intended to achieve the widest range of hip abduction.

The extensibility of the adductor muscles were estimated, before and after the training period, by measuring the between foot-distance, both legs being actively spread to a maximum (in an exorotation of 22°).

Descriptive details of the measuring procedure and apparatus are published elsewhere (12). The measured side split, relating to the length of the lower limbs, was taken as the flexibility index.

$$\text{flexibility index (F.I.)} = \frac{\text{side split}}{\text{length of lower limbs}} \times 100$$

The reproducibility of the measuring technique was checked in all subgroups by a test-retest procedure, before the training period. The correlations varied between 0.96 and 0.99.

Results

A gain in adductor extensibility has been observed in all training subgroups ($p < 0.01$). The control group, in contrast, revealed no significant changes in flexibility (table 1, fig. 5).

In order to compare the effectiveness of the various training methods, an analysis of variance (general linear models procedure, with repeated measurements) was carried out.

From this analysis it appears that the direct eccentric adductor training method (ECC.ADD) is the most efficient one.

In the three subgroups where this method was applied, the increase in flexibility was significantly higher than in the subgroups training according to other methods ($p < 0.001$).

No significant difference was found between the effectiveness of the three other methods (indirect or combined).

Discussion

The similar effect of diverse indirect methods of flexibility training is not surprising. Our findings only confirm the conclusions of other authors (1) (7) (14).

In a previous study, we already stressed the superiority of the direct method (12).

However, we did not invent a new technique. We only selected suitable exercises among existing dance movements : plié's and derived exercises. These movements are, depending on the authors, classified under passive as well as under active stretching exercises. To ensure that the adductors were actively stretched, subjects were asked to control and to slow down the movement in all situations where hip abduction was assisted by gravity

The effectiveness of the PNF method is widely disputed. Some authors consider the method superior to the classic, indirect ones (5) (9) (10) (11) (13); others judge it equivalent (2) (3) (4) (8) (14). In any case, comparison is difficult, since different modalities of this method are used.

A far better result from the variant of the PNF technique was anticipated in our study. Those techniques emphasize relaxation of the muscle to be stretched. The relaxation however is preceded by work against submaximal resistance done by agonists as well as by antagonists and always in an optimal range. We therefore, supposed that such a training produces not only a tonification effect on the muscle but also an increase in the active movement range. Our expectations have not been confirmed by the results. However, it must be conceded that the dancers found the method less attractive.

In conclusion, it is not yet possible to select safely the best stretching methods for different sport training and rehabilitation programmes. Further research

on different muscle groups, including thigh muscles is required, before we will be able to understand the underlying mechanism of 'elongating' muscles.

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