FLEXIBILITY: THE FUTURE

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Now that we have, perhaps successfully, redefined flexibility (Holt, Holt & Pelham, 1995 [a]) and explicated the various implications of research thereon (Holt, Holt & Pelham 1995 [b]), we can proceed to anticipating developments in the discipline. We will begin with a recapitulation in brief of the first two articles in this series, and proceed, through an examination of what is stipulatively and methodologically lacking, toward an elaboration, theoretical and practical of what needs to be done.

The first difficulty brought by investigation to our attention was one of definition. Attempts to define 'flexibility', we found, are generally inadequate. Major revision was indicated, but not without the necessary preliminary critique of the status quo. Only be discovering in what way previous definitions were inadequate could we direct our efforts toward formulating a definition in which such faults were conspicuously absent.

The fundamental inadequacy of all previous definitions is the confusion between what reveals a particular property and the property itself (Holt, Holt & Pelham, 1995 [a]). Although a range of motion is indicant of flexibility, it is not equivalent thereto. Flexibility is a property and, in this strict disciplinary sense, joint and joint group specific. It is not a measurement, it is to us by measurement revealed.

What remained was to formulate a new definition that both expressed that flexibility was an inherent property and avoid problems of definitional inadequacy to which previous definitions succumbed. Flexibility, we now believe, is the intrinsic property of body tissues which determines the range of motion achievable without injury at a joint or group of joints (Holt, Holt & Pelham, 1995[a]).

In the second article (Holt, Holt & Pelham, 1995 [b]), we provided an overview of what research tells us about flexibility. There was in the literature consensus as to the importance of flexibility as a component of fitness, an importance which rests on what are held to be three essential benefits of ,flexibility increase. Firstly, an increase in flexibility results in increased range of motion (Holt, 1974; Smith, 1982). Secondly, an increase in flexibility results in increased performance (Cavagna, Dusman & Margaria, 1968; Dubuc & Bohannon, 1985; lashvili, 1983; Prichard, 1987; Shellock & Prentice, 1985; Smith, 1982). Thirdly, an increase in flexibility helps prevent injuries (Greipp, 1985; Holt, 1974; Levine, Lombardo, McNeely & Anderson, 1987; Taylor, Seaber & Garrett, 1985).

Women tend to be more flexible than men (Alter, 1988; Kirchner & Glines, 1957), and people tend to become less flexible with age (Clarke, 1975; Corbin & Noble, 1980; Smith, 1982; Stanish & Hubley-Kozey, 1982). It has been suggested that both heat (Alter, 1988; Shellock & Prentice, 1985; Stanish & Hubley-Kozey, 1982; Williford, East, Smith & Burry, 1986) and cold (Cornelius & Jackson, 1984; Lehmann, Masock, Warren & Koblanski, 1970) augment flexibility, but around this question looms an as yet unresolved controversy. Degree and type of exercise, especially without compensatory exercise, may restrict flexibility (Bach, Green, Jensen & Savinar, 1985; Holt, 1974).

Of the various methods advocated to increase flexibility, stretching is the most effective (Shellock & Prentice, 1985; Wiktorsson-Moller, Oberg, Ekstrand & Gillquist, 1983). And although no studies have contradicted this conclusion, it has been suggested that massage and warmup are somewhat effective in increasing flexibility (Crosman, Chateauvert & Weisberg, 1984; Salzmann, 1982), and may with favourable results complement any stretching regimen (Shellock & Prentice, 1985; Williford, East,

Smith & Burry, 1986).

There are three basic kinds of stretching, ballistic, slow stretch, and proprioceptive neuromuscular facilitation. On the whole, research shows us that PNF and its derivatives are the most effective techniques for increasing flexibility (Greipp, 1985; Holt, Travis & Okita, 1970; Holt & Smith, 1983; McAtee, 1993; Prentice, 1983; Sady, Wortman & Blanke, 1982; Wallin, Ekblom, Grahn & Nordenborg).

We have come now to a crucial point. Having discussed what it is that research tells us about flexibility, we are left with what upon reflection are quite obvious implications about what research does not tell us about flexibility. In other words, now that we have taken stock of what has been done, we are both able and obligated to say what needs to be done.

Methodological analysis of the studies reviewed in the second article was quite revealing. We found that some experiments were well designed, but that some, for various reasons, were ill designed. Even those that were well designed and yielded convincing conclusions were less than perfect. In addition, endemic to these kinds of studies is the inevitability of confounding variables, which undermines not so much the conclusions themselves as the confidence which we can justifiably have in them.

Accordingly, those conclusions which have thus far been reached are to be qualified, as is our belief in their apparent veracity. To the best of our knowledge, what has been put forward is true, which means, in essence, little more than that these are the best answers we have, and that although we take them to be true provisionally, we cannot endorse them as definitive answers to still essentially open questions.

What is therefore required of us is, on the one hand, verification of our conclusions, and on the other, extension of our inquiries, theoretical, experimental and practical, into as yet untapped areas of research. This being said, we are now prepared to enumerate what are our future needs.

Firstly, there is needed an increase in the number of researchers concerned with flexibility, an increase which would by consequence augment the number and quality of studies in this area. The reason for this is obvious. As important a component of fitness as flexibility is, its significance is underrepresented both in the literature and on the playing field. Balance is as essential a component of fitness research as it is of fitness itself, and it is about time that these realizations had an appreciable effect on fitness and health professionals.

Secondly, there is needed significant improvement in the accuracy and precision of technology used in flexibility research. The application to such research of already existing technologies is indicated. Three dimensional analysis, online readouts, field measures, and telemetry are all applicable, but have yet to be applied, to flexibility research. The greater the accuracy and precision of measurements obtained in flexibility research, the greater the validity of, and the greater the confidence we can have in, our conclusions.

Thirdly, there is needed information on flexibility requirements for each of our numerous and varied sports/activities. How does it affect performance and possible injury?

Fourthly, there is needed a practical means to achieve increases in flexibility. And ideally, of this practicality there are many components. One, the means must involve stretching, the most effective way of increasing flexibility, and PNF, the most effective way of stretching. Two, it must, while retaining the benefits of PNE, do away with the necessity of partner assistance. Three, it must be safe. Four, it must be user friendly,

adaptable to all body types and flexibility needs. Five, it must be progressive, capable of keeping up with and surpassing the improvements it helps to achieve. Six, it must provide instantaneous feedback so as to positively and negatively reinforce accordingly behaviour aimed at facilitating flexibility.

Damage to soft tissue at home and in the workplace, as well as in the sportplace, is unfortunate and all too common. What research tells us about flexibility, and especially what it has *failed* to tell us about flexibility, gives us direction for the future. There might and should come into existence machines designed to increase flexibility, and thus reduce the severity of soft tissue problems, decrease recovery time from injury, and enhance not only performance, but also general wellbeing. A need cries out to be met, and those in the exercise professions, armed with information and purpose, should be prepared to meet it.

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