MEDICAL EDUCATION

Biomechanics, a Required Course for Medical Students : a Rationalization

By Mohamed A. Ragheb*

Biomechanics by definition is "the mechanics of living systems" [1] and "the application of mechanical principles to the human body" [2]. The definition shows that biomechanics has something to serve anyone dealing with the human motor system. Wartenweiler[1] listed sports and physical education, manual labour, orthopaedics and rehabilitation as areas concerned with human motion and therefore involving biomechanics. Contini and Drillis[3] date the development of biomechanics to the early 1950s. Since that time a rapidly increased awareness has come from the areas of physiotherapy, sports medicine, physical education, orthopaedics and industry [4,5]. There are biomechanics courses within academic graduate and undergraduate programmes of physical education in a majority of the universities all over the world. The same thing could be applied to the faculties of physiotherapy. With regard to manual labour and industry, biomechanics has been established through the subject of bio-engineering. However, in the medical academic programmes the subject of biomechanics is not dealt with satisfactorily, although there are many MDs working in biomechanics research programmes and during the international meetings of biomechanics attention is directed towards medical application.

It was pointed out very clearly by Wartenweiler[1], president of ISB during the international congress 1973 that "If the movement varies from the normal standard, we have to reckon with disturbed or pathological forms which occur especially in cases of cerebral disorders. To eliminate disorders it is important to diagnose them as early as possible. It would be worthwhile to investigate them with biomechanical parameters."

It is the aim of the present work to bring attention to the importance of developing a biomechanics course for the medical student and provide valid justifications for doing so.

METHODS

The present study was developed through the following two phases:

Phase I

The required data was made available from : a) Interviews and b) Reference analysis.

A sample of 150 scientists who attended the international congresses of (1) Commonwealth at Glasgow in 1986, (2) Sports medicine and biomechanics of swimming at Bielefild in 1986 and (3) Biomechanics at Amsterdam in 1987, were interviewed to get their opinions about the following questions :

a. Do you agree that biomechanics should be a required course for medical students? (yes/no/don't know)

*Assistant Professor of Biomechanics
University of Bahrain

If your answer is yes :
b. What medical specialities do you recommend for it?
c. What are the applications you expect biomechanics to have in the medical field?

The interviews were taped and answers were analysed in terms of percentages.

The available references dealing with the importance of biomechanics and its applications in the medical field were analysed.

Table 1

Opinions about Biomechanics as a Required Course for Medical Students

Opinion	*Agree*	*Don't know*	*Disagree*
Percent	92	6	2

Table 1 shows that the majority of the surveyed sample agreed that a biomechanics course should be included in the academic programme of medical schools. However, agreement was accompanied by restrictions about the specialities which need such a course. Table 2 manifests the opinions about this concern.

Table 2

Opinions about Specialities Requiring Biomechanics Knowledge

Speciality	*Percentage*
Orthopaedics	90
Rehabilitation	90
Electromyography	85
Neuromuscular control	70

Referring to the proceedings of the international congresses of biomechanics (1967-78) these five specialities appear to occupy a settled place and separate sessions in the programmes of the ISB congresses.

The need for biomechanics in the orthopaedic and rehabilitation areas has been emphasized by Wertenweiler[1] when he stated that "orthopaedics and rehabilitation are important practical fields of biomechanics."

The applications of biomechanics in the clinical area was an open-ended question :

40% of those interviewed stated that in manual muscle testing the skill of the clinician in applying test forces of varying degrees of magnitude to estimate the patient's ability to resist these forces depends on his knowledge about the lever arm lengths involved in the muscle test, as well as the applied forces. Leveau[6] stated the same idea.

60% of the sample saw that knowledge of the mechanism of injury is very helpful in evaluating the injury accurately, agreeing with the view point of Arnheim[7].

80% of the opinions revealed that biomechanical analysis of the rehabilitation exercise provides necessary information to establish a safe and effective programme. At this point it should be borne in mind that the forces involved in certain exercises may exert stress that could damage the joints and soft tissues of the body.

60% of the sample agreed that knowledge of biomechanical principles provides a good understanding of normal growth and the development of postural deformities. Physicians use this data in making decisions about the extent of the problem and method of treatment. The properly applied casts, braces or splints provide the necessary force to correct a deformity.

75% of the sample suggested that the use of traction, which utilizes force to overcome gravity and friction, and the use of crutches and canes to relieve forces of gravity on an injured or weak body part are based on biomechanics laws.

80% of the opinions showed that the evaluation of the patient's posture while standing, sitting, moving objects and treatment procedures of postural deformities are based on biomechanical principles.

90% gave the opinion that evaluation and treatment of gait problems are based mainly on biokinematic parameters of displacement, velocity, and acceleration.

85% saw that biomechanical data is required in the adjustment of braces and prosthetics. To quote Wartenweiler[1] "If artificial limbs should be fitted, the characteristics of moving with the sound ones should be well-known. Biomechanics will thus have to give data about the pilot and regulative conditions."

Phase II

The second phase of this work was to present the results of phase I in the session of medical education in the Middle East conference, Bahrain (1987) to get the reactions of the experts in medical education about biomechanics as a required subject for medical students. The board and floor discussions showed that biomechanics could be welcome as an important subject in the preparation of medical students. Questions arose as to how it can be accommodated in the heavy academic programmes of medical schools and also how can it be geared to the programmes of the schools which apply the so-called problem-based learning.

Five experts (Professors at medical schools) were available for interview after the session in a quest for answers to the previous questions. The results of the interviews led to the suggestion that a biomechanics introductory course could be offered in the pre-medical programme to provide the students with knowledge about biomechanics as a descipline and the cases and clinical situations in which they have to consult biomechanical resources. During the academic sessions the students should be encouraged to deal with the biomechanical aspects of the case.

CONCLUSION

It could be stated that biomechanics is a useful tool in some medical areas where it can be helpful in providing dependable data in diagnosis, assessment and treatment processes in many clinical situations. A course in clinical biomechancis is recommended for medical students. Attention should be focused on the design of specific biomechanics introductory course for premedical students.

REFERENCES

1. Wertenweiler J. Status report on biomechanics. In : Cerquiglini S, Venerando A, Wertenweiler J, eds. Biomechanics III (medicine and sport services). New York : Karger and Basel, 1971;8:65-68.

2. Hochmuth G. Biomechnik sportlisher bewegungen. Berlin : Sportverlag, 1967; 1.

3. Contini R, Drillis R. Biomechanics in applied mechanics survey. New York : Spatan Books, 1966;2.

4. Rash PJ. Notes towards on history of kinesiology. J Am Osteopath Assoc 1958;I:572-574, 1958;II:641-644, 1958;III:713-714.

5. Miller D, Nelson RC. Biomechanics of sports. Philadelphia : Lea and Febiger, 1973.

6. Leveau B. Biomechanics of human motion. Philadelphia : W B Saunders Co, 1977;2.

7. Arnheim DD. Modern principles of athletic training. Toronto : Times Mirrow/Mosby College Publishing, 1980;223.