

## SOME BIOMECHANICAL ASPECTS OF MASSAGE

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**Abstract:** Some historical points of massage development are considered (Hippocrates, Avicenna, etc.). The definition of concept "massage" is given, the ways of massage (petrissage, rubbing, stroking) are described. The elementary biomechanical analysis of ways of massage is adduced. It is showed that there is a necessity to build exact mathematical models of massage with the help of joint efforts of physicians and mathematicians.

**Key words:** massage, petrissage, rubbing, stroking, biomechanical analysis

"Massage" is one of the most ancient medical concepts. The radical of this word is treated with some differences in various languages of the world: massa (Latin) - adhering to fingers, masso (Greek) - to clench by hands, mass (Arabian) - gently to press, etc.

Papyri and clay plates with the imprints of various methods of massage used in Ancient Egypt, Abyssinia and other countries have been found. The detailed description of methods of petrissage, rubbing, stroking and instructions to their application at various illnesses were found in old Indian treatises.

The scientific substantiation of rachistherapy which was a prototype of a modern manual therapy was given by Hippocrates.

Massage methods were extensively described in Avicenna's scholarly works "The Canon of Medicine" and "The Book of Healing" (the first century A.D.).

In the sixteen century A.D., the encyclopedia "San-Tsai-Tu-Gasi" systematizing massage methods was issued in 64 volumes in China, and already at the beginning of the eighteenth century in Germany Goffman has completed his handbook "Mechanotherapy" considering massage as one form of biomechanotherapy.

The modern qualifiers define massage as a dosed mechanical effect on a human body by a manual or apparatus method for a medical or preventive objective. The role of psychobioenergy influence of a masseur on a patient during a session of massage only is meant. It facilitates a construction of a sequence model as a biomechanical one, which one can consider the given medical procedure as a sequence of physical stimuli of various form, power and intensity acting on certain surface of a body during specific time (average duration of a procedure of massage is 10 - 20 minutes).

This mechanical energy turns into the energy of nervous excitation. By an stimulation of nerve endings, the permeability of their shell increases especially for ions of sodium that causes appearance of receptor potential and appearance of ionic currents - stimuli of nerve fibers. The originating nervous impulses reach central, peripheral and vegetative nervous system. Load dosage on the surface in a session of massage depends both on a selection of massage methods and on a character of their alternation.

The methods of stroking are the most sparing types of mechanical effect. As a rule they are used at the beginning and at the end of session of massage, moreover they are applied at pauses between other stronger massage ways.

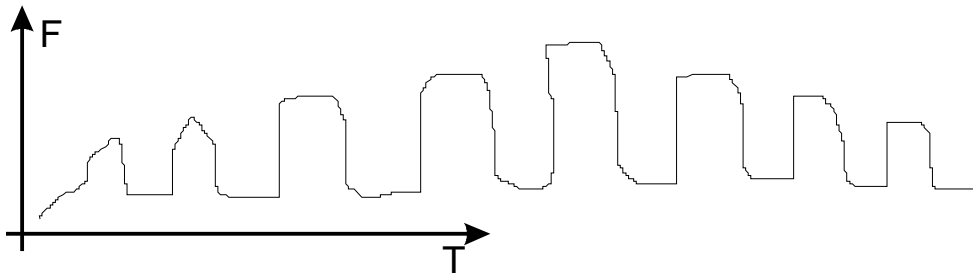


Fig. 1. The schematic graph of load dosage during a session.  
 F - is force of massage ways of treatment,  
 T - is time of a session, ways of stroking, petrissage,  
 rubbing and vibration.

The load dosage during a session is illustrated schematically in Fig. 1.

In a session of medical massage, the stroking usually takes not less than 35-40 % of the total session time.

At treatment of serious patients, this time can be enlarged by 15-20 % and at realization of sports restoration massage this time is essentially reduced.

The ways of rubbing are more intensive, they effect not only on receptors of skin but also on nerve endings of subcutaneous strata of tissues starting up simultaneously mechanism of hormonal control of an human organism. The displacement of skin causes not only organism local response appearing as an improved metabolism (lymph-blood circulation, excretory and respiratory function of skin, etc.), but also calming or irritant effect on the central nervous system.

The ways of petrissage are directed to deeper muscular strata of a body. The masseur must take great efforts vertically in relation to area of effect.

The amount of ways of prestrissage in a massage session depends on the objectives

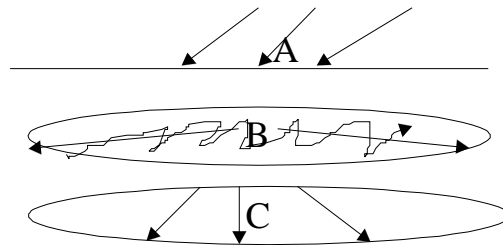


Fig. 2. The schematic graph of responses on the rubbing  
 A - local response,  
 B - hormonal response,  
 C - nervous-reflex response.

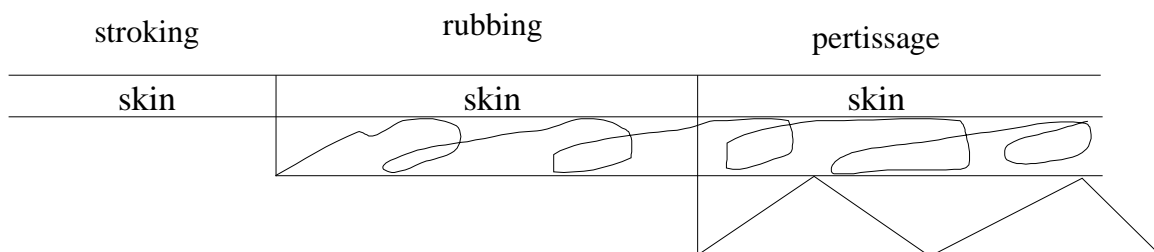


Fig. 3. The comparative image of the ways of massage.

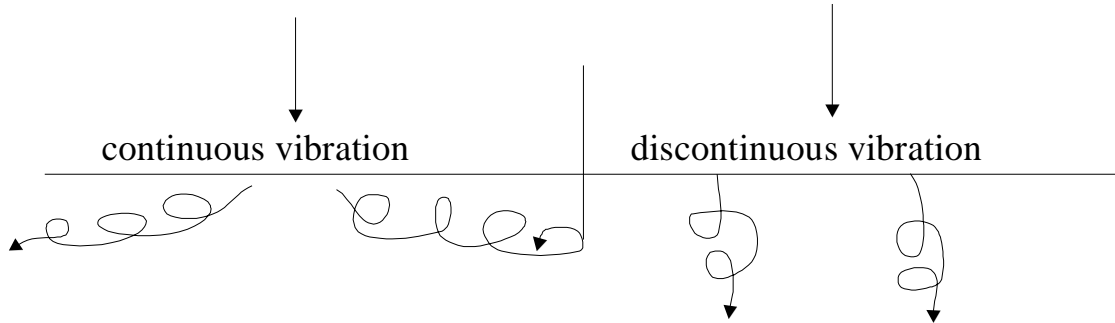


Fig. 4. The scheme of vibration.

and tasks. In sport restoration massage they can take up to 75-80 % of total time of the procedure being as though in inversely proportional relation with ways of stroking.

One more way of massage is vibration involving oscillations of massage areas of various amplitude and duration. These oscillations spread either on the superficially located tissues (continuous vibration) or deep into tissues (discontinuous vibration).

Both main and auxiliary ways of manual massage depend on anatomic- topographical features of massage areas of a body and certainly on individual features of the masseur, structure of his hands, mobility of joints of his fingers, etc.

The apparatus massage is developed as an additional direction of massage for the purpose of facilitating of masseur work.

Operation of the numerous created devices for hydromassage, vibrating massage and pneumomassage can be described with the help of mathematical modeling. It will make it possible to build mathematical models. The formulation and solution of the given problem on the boundary of the twenty first century is rather actual and must be solved by collaboration of physicians and specialists on biomechanics.

### **Некоторые биомеханические аспекты массажа**

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«Массаж» является одним из наиболее древних медицинских понятий. Корни этого слова имеются во многих языках (латынь, греческий язык, арабский язык). Отпечатки, изображающие различные приемы массажа, обнаружены на папирусе, глиняных пластинках, найденных в Древнем Египте, Абиссинии и других странах. Описание приемов массажа (разминание, растирание, поглаживание) имеется в древних индийских трактатах, работах Гиппократ, Авиценны, китайской энциклопедии XVI века. В настоящее время под массажем понимают дозированное механическое воздействие на тело человека с помощью рук или специальной аппаратуры. В работе приведено краткое описание приемов массажа, дается первоначальный биомеханический анализ этих приемов. Указывается на необходимость построения точных биомеханических моделей массажа в результате совместных усилий медиков и специалистов по биомеханике.

Ключевые слова: массаж, разминание, растирание, поглаживание, биомеханический анализ

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