THE CONCEPT OF MANUAL SKILL EDUCATION IN STOMATOLOGY AT “APOLLONIA” UNIVERSITY OF IASI

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Abstract

In the usual university curricula of stomatology, the aspects related to the education and preservation of manual skills are not thoroughly and sufficiently studied, which explains the theme of the present study, dedicated to the reorganization of the curricula content of the disciplines involved in the development of practical competences in the field.

Each student possesses a certain individual manual skill, understood by the teacher only superficially, which is also the case of his natural aptitudes and deficiencies.

That is why, the training developed during student years should be prolonged along the whole professional career of the stomatologist, which requires changing of one’s usual attitude versus his own performances, along with a conscious and continuous education for maintaining and developing the expected practical competences.

Special attention should be paid to avoiding physical and psychic fatigue, by a corresponding dosage of the intensity of one’s activity, along with a suitable prophylaxy of occupational pathology by practising of relaxation exercises adapted to such a specific profession.

An important premise of the implementation of the concept of manual skill refers to the fact that instrumentalyzed parctising of dental medicine, always influenced by the continuous technological development, assumes the utilization of a large range of medical apparata and devices, in the absence of which stomatology would be a wholly different thing.

Organization of an ergonomic stomatological system represents another important objective of the program of skill education as, in itself, it does not cover the shortcomings of a disordered activity.

Essential in such situations is the sequential knowledge of the execution times for the various restorative dental, endodontic, periodontal, surgical, prosthetic procedures, on categories of age, the realization of which maintains the manual skills, by their execution on electro-mechanical and haptic simulators and by the development of practical competences on the pacient, under the direct supervision of the didactic staff, after practical demonstration.

Keywords: manual skill, dynamic stereotypes, education and maintenance, ergonomic stomatological system.

The profession of stomatologist requires – apart from the theoretical and practical knowledge specific to dental medicine – some solid, fundamental and general medical-surgical knowledge. To attain such an objective, the academic curricula of “Apollonia” University of Iasi is judiciously structured into several groups of disciplines, whose learning will assure the professional profile of the future physician, as well as an extended horizon for the specialist, as follows: fundamental, medical-surgical general disciplines, complementary general and medical disciplines – representing more than 1/3 of the total number of hours, as well as disciplines specific to stomatology – representing 2/3.

Among these disciplines, mention should be made of a special group, which follows the development of the behaviours and habits known as practical competences. It goes without saying that this aspect is essentially based on a thorough theoretical study of the various disciplines forming the curricula, which actually represents the origin of the trans- and inter-disciplinary complex Appolonia concept of education and long-life maintenance of the manual skills. The group here under analysis includes disciplines harmoniously completing one another along the 6 years of study. (Table 1)

1. The first reason for which the education of the manual capacity of the stomatologist aroused a special interest is that the common curricula do not pay the necessary attention to the education and maintenance of manual skills, which explains why the curricular content of the disciplines responsible for such aspects (obtaining of practical competences) has been modified.
2. Apart from this, it is known that each student has his own individual capacity as to the manual skills, understood by his teacher only superficially, to say nothing of the aptitudinal deficiencies that may occur. A common saying is that one practitioner or another has 2 left hands, referring to frequent failures caused by certain morpho-functional vices. In this respect, a laboratory for psychological investigations – with a corresponding specialized staff – has been created at “Apollonia” University, as well as an office of school medicine, where the students are evaluated by neurological, ENT, ophthalmologic, endocrine, somatometric investigations for obtaining an initial diagnosis of the psychomotor capacities required for and expected from a good physician – figs. 1, 2.

The motor behaviours that should be obtained and exercised in specific surgical – and, especially, stomatological – praxis, refer to: Basic motor,
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more or less instinctive behaviours (a. Visual-motor coordination; b. Static and dynamic equilibrium; c. General dynamic coordination), Neuro-motor behaviours (a. proprioceptivity, b. muscular tonus) and Perceptive-motor structures and behaviours related to intelligence (a. Bodily scheme; b. Temporo-spacial orientation). The attributes of motor intelligence include:

- **Intuition** – operativity in selecting the motor program adequate to the situation and intention;
- **Rapidity** in comparing the alternatives;
- Possibility of elaborating the motor program over a short period of time;
- **Capacity of rapid processing** of a large amount of sensorial information and of catching the relevant piece of information, necessary to the motor reaction;
- Capacity of rapidly understanding the motor function;
- Easiness of transfer;
- Motor creativity;
- **Anticipation** – coincidence.

Following the initial evaluation, testing students’ psychomotor aptitudes and their conscious attitude vs some possible aptitudinal deficiencies, the individual training file is elaborated, involving evaluation of the evolution stages during student’s advance in his professional training.

3. The third objective in the implementation of the skill education concept is represented by the necessity of prolonguing the training begun during the student years along the whole professional existence of the physician, and of adopting a modified attitude towards one’s own performances, alongwith a conscious education of the specialist for acquiring better practical competences [1-3].

The factors for the evaluation of the acquired skills should be permanently monitored, according to objective, clear-cut criteria. (Table 2)

4. Special attention should be paid to avoiding physical and psychic fatigue by a corresponding dosing of labour’s intensity and by a prophylaxis of occupational pathology by means of relaxation exercises adapted to the specific character of the profession [4-6]. Our concept refers to the maintenance of the mobility of the joints of interest, of the general comfort of the organism, to learning and practising relaxation exercises, as well as to the introduction, in the professional behaviour of the student – during his years of study and also along the whole life of the future physician – of a constant preoccupation for acquiring manual technical automatisms.

5. An important premise in the implementation of the concept of manual skill refers to the fact that instrumentalized practising of dental medicine, always influenced by the continuous technological development, assumes the utilization of a large range of medical apparata and devices, in the absence of which stomatology would be a wholly different thing. All these assume a minute knowledge of the biological and therapeutical effects produced by the physical agents employed (plasma, laser, ultraviolet or X rays, electrical current etc.) during their manipulation, as well as a corresponding concentration from the part of the specialist, for avoiding any possible medical errors [7-9]. The first one to have introduced, in the university curricula, such original principles, applied within the discipline entitled Bioinstrumentation, was prof. PhD Vasile Burlui.

6. Organization of the ergonomic system represents another important objective of skill
**Table 2**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Description</th>
<th>Test</th>
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<tbody>
<tr>
<td>1. Precision of the control</td>
<td>Of interest are the MS and MI movements</td>
<td>Circular following</td>
</tr>
<tr>
<td>2. Coordination of all members</td>
<td>Capacity of simultaneous coordination of the movements of various members</td>
<td>Coordination of both hands</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The rotation test may be considered as valid.</td>
</tr>
<tr>
<td>3. Orientation of the response</td>
<td>A common factor for the psychomotor functions on the visual discrimination reaction</td>
<td>Time of discriminative reaction</td>
</tr>
<tr>
<td>4. Reaction time</td>
<td>Speed at which a subject is capable of responding to a stimulus, when it appears</td>
<td>Classical reaction test to a light signal</td>
</tr>
<tr>
<td>5. Rate of movement</td>
<td>The speed at which a subject may perform a large arm movement, without imposing high precision</td>
<td>The objective is the rate at which one may react to external stimuli.</td>
</tr>
<tr>
<td>6. Speed control</td>
<td>A common factor for the functions involving a continuous anticipation to the motor adaptations related to the changes of speed and/or direction of a moving object.</td>
<td>To maintain a line which changes its position accidentally on a certain target</td>
</tr>
<tr>
<td>7. Manual skill</td>
<td>Capacity known in labour psychology. Adaptation of the MS direction when manipulating big objects</td>
<td>“Minessota” manipulation test and “O’Connor” test</td>
</tr>
<tr>
<td>8. Finger skill</td>
<td>Manipulations of small objects, involving participation of fingers</td>
<td>Purdue test</td>
</tr>
<tr>
<td>9. Arm safety</td>
<td>Precision in the realization of the movements performed by the arm-hand assembly, without involving either speed or force. This factor also involves positioning of the arm-hand assembly. “tapping”.</td>
<td>Test similar to the “Greek” one of Bonnardel</td>
</tr>
<tr>
<td>10. Speed of the fist-fingers assembly</td>
<td>Hand-eye coordination</td>
<td>(acc. to Thomas, 1995, p. 54)</td>
</tr>
<tr>
<td>11. Scoring or targeting</td>
<td>Hand-eye coordination</td>
<td></td>
</tr>
</tbody>
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**education**, as this cannot cover by itself the inherent shortcomings of a disordered activity. Medical dental practice makes use of numerous techniques, employing various instruments and a perfect manuality, stomatology being, first of all, a surgery branch of medicine. As a matter of fact, the name of “surgery” derives from the Greek term “kheiros” – namely a hand-made, manual activity. Diversification of the aparata, instruments and of the materials utilized in stomatology, the multitude of techniques that may be applied during surgical interventions,
in several cases particularized for each of them in part or even for each patient, a situation obviously requiring an increased intellectual effort, a working site very precisely limited, flooded by saliva \((i.e., the\ oral\ cavity)\), belonging to a living organism with normal defense reflexes, the painful sensitivity and the vomo reflex, the mobility of the soft parts, the scarce luminosity and the difficult illumination required a strict ergonomic organization of stomatological activity at all levels, starting with the most characteristic element: the medical action. Attaining performance, safety and, implicitly, the comfort of the stomatological team requires organization of the professional space. The scientific preoccupations of prof. PhD Vasile Burlui in this forward-looking domain, as well, made possible publishing, in the year 1991, of the first book of Stomatological Ergonomy in Romania, the volume structuring the main elements of the stomatological activity into 8 original criteria: antropometric, physiological, neuro-psychic, chronobiological, ambiental, of the specificity of the activity, of economy and professional competence.

As in any ergonomic system, and mainly in the stomatological one, the specialist should examine two compulsory stages: knowing and learning of certain techniques, positions, ergonomic movements, their transformation into habits and the permanent care for self-perfectioning, through continuous self-control and correction \((auto-training)\) \([10,11]\).

Implementation of the decisions taken by the operator involves the muscles of the members, while the behavioural motor activities and the vegetative reactions accompanying them are assured by the integrated and integrating activity of the nervous system. Brain mechanisms help to maintain position, to adjust the posture, determining the voluntary movements performed under motor, brain as well as basal cortical control. Numerous automatized movements occur at subcortical level \([12,13]\). The complex motor activities are assimilated and finalized at cortex level (temporal superior angular girus of the dominating hemisphere), while determination of movements’ sequence – within the somatic ares – fig. 3.

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**Fig. 3 – Cortical representation of the motor areas**

In such a context, it is especially important to evidence the realization of the mental image of the bodily scheme that should be known by the stomatologist. (Table 3)

The interrelations among the elements forming the ergonomic system are illustrated in fig. 4.

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**Fig. 4**

Between the operator and the equipment used, some dynamic relations of physical (energetic consumption through muscular contraction) and, especially of sensorial and psychic nature, are established. In stomatology more than in other fields, the professional equipment intervenes between the physician and the patient and, consequently, the antropometric data are useful for showing that the background is suited for the operator (designing and selection of the professional equipment). As in any other surgical specialty, the first time refers to the establishment of the optimum working position, for
adjusting the gestures through specific training exercises, up to their automatization. The sitting position helps the operator to stabilize the joints of the body, to maintain a comfortable, stable position and minimum muscular contraction, the ideal position for the fine movements to follow – fig. 5.

| Table 3 |
|---------------------------------|---------------------------------------------------------------|
| Visually: (optic analyzer)      | Recognition of the bodily segments and of their position, in the relation with objects and space |
| Sensitively: exteroceptive (tactile analyzer) | Recognition of the bodily segments as to the exogenous sensitive stimuli |
| Proprioceptively (chinesestic analyzer) | Knowledge on the position of the bodily segments during movement, leaving aside sight |
| Vestibularly (static-dynamic analyzer) | Recognition of bodily position in relation with both rectilinear and rotation acceleration and slowing down movements |
| Capacity of imagining – formal operations | Knowing of the potential utilizations of the bodily segments |
| Cognitivo-intelectually | Conscious recognition of the segments, their denomination, capacity of utilization and of conscious control |

Another important objective in the implementation of the skill education concept is the sequential knowledge of the execution times for the various restorative dental, endodontic, periodontal, surgical, prosthetic procedures, on categories of age, the realization of which maintains the manual skills. Training through simulation represents an essential condition for observing the ethical principles.

Electro-mechanical simulators

The above-described reasons explain the introduction, in the stomatological medical training process, of electro-mechanical stimulators for preclinical disciplines – Cariology, LOC, EPIR, the method being extended to periodontology, implantology, dento-alveolar surgery, anaesthesiology etc.

Even if, lately, the electro-mechanical simulators lost the leading position they used to occupy, being outdistanced by the virtual, computer-assisted ones, they continue to provide an
unanimously accepted classical method by means of which students may transfer their didactic knowledge towards the clinical domain, and visualize and understand the treatment procedures (preparation of a cavity, organic substructures etc.) – fig. 6.

**Fig. 6 – Electro-mechanical simulators**

**Haptic simulation**

The Simodont simulators based on haptic technology have been created for the realization of various procedures of stomatological treatments for didactic purposes.

The haptic technology reproduces the real sense of touching in a virtual environment. The simulation units based on this technology provide multiple treatment procedures, applicable in a virtual background, which can be however sensed as due to a high-fi “feedback” force. This type of virtual simulator offers to the student the possibility to learn, to exercise and to manipulate the working instruments in a most realistic manner – fig. 7.

**Fig. 7**

Fully aware of the importance of dental medical procedures’ simulation prior to stomatological praxis, “Apollonia” University has been equipped, for the first time in East Europe, with 4 MOOG units, which permits to both students and graduates to exercise, under conditions similar to those of the oral cavity, many of the therapeutical manoeuvres in use and to receive an objective evaluation – figs. 8,9.

Even if, in some countries, medical practice on the ill ones is not permitted, it is our firm opinion that the student cannot be deprived of the opportunity of performing a clinical norm on the patient, under the direct supervision of the teacher, correlated with the acquisition of extended practical competences, so necessary to the future specialist. This explains the necessity of simulation in dental medicine, prior to any praxis on the patient.

**Figs. 8, 9 – Education of students’ manual skills at “Apollonia” University by MOOG haptic simulation**
In this way, the student has the opportunity of approaching a real subject, in the atmosphere of the clinical office, but only after a clinical demonstration performed by a specialist.

Clinical approach assumes the assimilation and execution of the techniques previously exercised on simulators, by their application to the patient, under the strict surveillance of the teacher. The permanent contact with specialized stomatological clinics is beneficial and extremely useful [14,15]. The clinical standards that should be compulsorily attained in each discipline include resuming of the manoeuvres taught in previous years, which will assure a thorough mastering of the practical competences, along with improvement of self-control.

As to the ethics of the medical training on the patient, the 5 ethical principles, namely: patient’s autonomy, non-iatrogeny, the good action, fairness and veridicity, should be strictly obeyed. The development of an ethical behaviour in stomatologist students and exercising of their abilities according to professional ethics are especially important from practical considerations. Authentic education is the one that prepares the student for continuous learning, along his whole professional life. The teaching methods and the preclinical and clinical protocols should be elaborated for providing the basic ethic principles, in view of their further improvement and correlation with the stomatological practice.

Gradual evaluation of skill acquisition, viewed as competences acknowledged in the end of each year of study, challenges the student to improve the manual dynamic stereotypes, for assuring his permanent evolution, along with the obligation of maintaining such abilities along the whole professional life.

References