

PSYCHOMOTOR
SKILLS IN
ORTHOPAEDIC
SURGERY

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PSYCHOMOTOR SKILLS IN ORTHOPAEDIC SURGERY

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To our wives, Nona Lippert and Helen Farmer, for their support and forbearance during the preparation of this book and to our fathers, Frederick G. Lippert, II, and James A. Farmer, Sr., who first taught us basic psychomotor skills with a hammer and saw.

Foreword

To be an orthopaedic surgeon implies that one not only has acquired the requisite knowledge but has achieved a level of technical skill in or out of the operating room, sufficient to be able to produce a desired result. In this very complex field, a considerable amount of attention has been devoted to the cognitive domain. Candidates for acceptance to orthopaedic surgery teaching programs have been traditionally screened by reviewing medical school transcripts, college records, and the results of various tests developed to assess knowledge and the ability to acquire it. Relatively less attention has been paid to the applicant's surgical aptitude. This approach has derived some folksy support from an old saw "you can teach a monkey to operate, it is much harder to teach him to think." The fact of the matter is that there is some evidence that monkeys *can* carry out thought processes, but no one has yet demonstrated that a monkey can indeed be taught to operate.

In addition to the traditional lack of emphasis on evaluating surgical aptitude as a significant requirement for entering the field of orthopaedic surgery, there has often been a concomitant *laissez faire* attitude toward the teaching of surgical skills per se during the formal residency program. It has been generally assumed that the student will acquire sufficient expertise by watching his teachers perform or by performing himself under circumstances of variable supervision. Although a cognitive examination is given at the conclusion of a resident's formal education period, no such similar assessment is made of the young surgeon's abilities in the actual conduct of an operation.

Meanwhile, the environment for orthopaedic surgeons, in fact for surgeons of all types, has been changing. Operations have become increasingly more complicated from a technical standpoint, as for example, the replacement of an amputated thumb. The equipment used in the operating room, including implantable devices, has become highly complex. The expectations of the patients in today's world of sensationalized news reports have increased and are becoming more sophisticated. At the same time, the tolerance of these same patients for what they view as suboptimal results has lessened. Surgical errors become the basis for many of the lawsuits currently contributing to enormous insurance rates. All of these factors dictate a need to reevaluate the methods by which we select men and women for a career in orthopaedic surgery, and the techniques we use to insure for ourselves and the population we serve that they will acquire the necessary proficiency in the art.

Dr. Lippert and Dr. Farmer, with the publication of this book, are taking a long step in the proper direction. Both are highly qualified in their own fields—orthopaedic surgery and education, respectively. They have collaborated for many years on the theory and practice of teaching

orthopaedic surgery. Coming from diverse backgrounds, they happen to be uniquely qualified to provide us with the philosophical as well as the practical aspects of the teaching of psychomotor, or surgical, skills.

I have had the fortunate opportunity to have been able to watch the developmental phases that led to this book. Much of the evolution occurred during the preparation and conduct of courses for educators, sponsored by the American Academy of Orthopaedic Surgeons. Over the years that Drs. Lippert and Farmer served as organizers and faculty, much of the material so ably presented in the following pages was created and refined. During that period, I attended several courses and participated in many discussions with the authors and can attest to the innovative thought processes behind their ultimate methods of presentation.

The result as it stands here is an invaluable aid for all those who are involved in the education of orthopaedic surgeons. It nicely blends cognitive and motor aptitude into the psychomotor domain, and emphasizes appropriately the importance of affective behavior on the successful conduct of surgical procedures. Difficult concepts and relationships are ingeniously depicted in charts and diagrams to facilitate an understanding of the subject. Finally, concrete examples are used which provide for immediate transfer of philosophy to practice.

The practical exercises outlined in the final chapters of this work have been written by experts in their application. They provide not only invaluable insight into the procedures themselves but also serve as a guide to a rational approach to any complex surgical operation currently performed or yet to be developed.

The authors, therefore, deserve to be congratulated for being pioneers in the field of education of the orthopaedic surgeon. Their contribution should have far reaching effects as the principles they have worked out achieve the widespread attention that they deserve.

DAVID G. MURRAY, M.D.

Preface

This book has been written to provide useful information about psychomotor skills for medical students, residents, and practicing orthopaedic surgeons. Medical students will be introduced to the basics of surgical problem solving and the development of psychomotor performance in the operating room. By understanding the surgical team roles, indoctrination into the operation room environment will be a more meaningful and less stressful experience. Orthopaedic residents will understand the relationship of the cognitive, motor, and affective inputs to their own psychomotor performance. The section on orthopaedic problem solving should be especially helpful since it is the foundation for good habits in all phases of surgery. Knowing what their role is as an assistant and what to expect from their junior residents and assistants will enhance teamwork and provide a sense of satisfaction. At the attending level, one typically assumes that modes of thinking and acting are already fixed. However, reading this book should provide new methods for keeping current and preparing for unusual cases. By understanding the functional and dysfunctional effects of various behaviors in the operating room, those surgeons who see these characteristics in themselves are in a position to change.

At the end of the book are sample case workups showing the type of detail which is useful in preparation for surgery. It is the authors' contention that this format of preparation called the surgical diary represents a more practical and meaningful collection of reference materials than that which currently exists in atlases, textbooks, and manuals.

F. G. LIPPERT, M.D.

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This book would not have been possible without the involvement of many people with whom we have worked over the past eight years. David G. Murray, M.D., past president of the American Academy of Orthopaedic Surgeons, has provided leadership from the beginning in developing many of the educational approaches for continuing medical education in psychomotor skills. Carl L. Nelson, M.D., professor and chairman of the program at Little Rock, Arkansas, has also contributed uniquely to psychomotor skills teaching. His educational facility is a model for regional courses that bring state of the art surgery to local residents and attending physicians. Kenneth A. Briggs, M.D., an orthopaedic surgeon in private practice in Seattle, Washington, has worked closely with us ever since the first psychomotor course at the University of Washington. He has been on the faculty of the A.A.O.S. Psychomotor Skills Educator's Courses and helped write *The Psychomotor Skills Teaching Manual* by the Committee on Graduate Education. Richard M. Harrington, M.S. has participated in the development of exercises and testing at the University of Washington. Finally, Carol Foster has been an intimate part of all phases of psychomotor skills continuing education. She has helped coordinate academy-run courses and has done most of the manuscript typing for this book. We are deeply indebted to the above individuals for making this book possible.

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SECTION I

DEVELOPING AND MAINTAINING PSYCHOMOTOR SKILLS IN ORTHOPAEDIC SURGERY

CHAPTER I.1

THE ORTHOPAEDIC SURGEON:

1. Challenges of the field.
2. Learning psychomotor skills.
3. The operating room.
4. Attributes of the orthopaedic surgeon.
 - A. The affective, cognitive, psychomotor triangle.
 - B. The heart, the mind, and the hand concept.

Orthopaedic Surgery Today

THE CHALLENGE

Orthopaedic surgeons today are faced with a continuously expanding technology. Restoring altered joint function to normal and severe skeletal injuries to pre-injury anatomic status is now possible with present technology. Local and national standards of care require the achievement of a high degree of functional restoration and reflect constant change in the state of the art. The orthopaedic device market is replete with implants and internal fixation devices of many sizes and purposes. Each orthopaedic rehabilitation system has its own advocates. Similar systems use special tools (such as jigs and props) which rarely can be used with other systems. Each system requires a learning curve before cases can be done in a routine manner. While tertiary care teaching centers generally have an abundance of patients, the surgeon in private practice may find that the number of available cases is not sufficient to keep current with all new techniques. Orthopaedic surgeons are faced with an increase in the number of their own colleagues, resulting in a decrease in the number of cases through which they may maintain their surgical skills.

With more exotic technology come greater complications. With joint replacements and the use of polymethacrylate cement have come bone and joint infections which are difficult to eradicate. Salvage procedures following failed implant arthroplasty are a challenge because of extensive bone loss. In addition, patients with difficult problems are frequently dealt with by a team approach. Thus, two teams of surgeons may be working on opposite extremities or from the front and back of the spine. The smooth coordination of this team is a challenge. In summary, the orthopaedic surgeon is faced with increasing complexity both in the type of surgery and devices used while, at the same time, there is a decreasing number of cases from which the necessary skills can be developed.

HISTORICAL REVIEW OF LEARNING ORTHOPAEDIC PSYCHOMOTOR SKILLS: EDUCATIONAL AND TESTING DEVELOPMENTS

It is surprising given the technical nature of orthopaedic surgery that formal attention to technical skills has not been developed until relatively recently. The concept of learning technical skills on simulators has been prevalent in industry for many years (1). Interest in improving the technical part of orthopaedic training first began formally in 1962 when the American Academy of Orthopaedic Surgery co-sponsored Phases I and II of the Orthopaedic Training Study (14, 15). This study was carried out at the University of Illinois Center for Educational Development under a government grant. Phase I began in 1962. One of the reasons for this study was the recognition that orthopaedic surgical training largely

consisted of an apprenticeship-type relationship with little formal skills training. In fact, it was determined that residents learned their operative skills more from peers than from their attending surgeons. Phase I was designed to collect and evaluate performance characteristics of orthopaedic surgeons. Out of this study came a list of important factors which attempted to define the ideal behavior in the cognitive, affective, and psychomotor domains. In addition, the study looked at different ways in which orthopaedic surgeons could qualify for board certification. The task force was specifically interested in alternative ways of testing individual competence instead of through the existing rigid training requirements. In 1971, the training study task force met in Chicago to develop educational materials for self-instruction in surgical skills, traction, and plaster work. The approach was to start with instrument familiarization. Knowledge of the proper use of instruments was believed to be the basis for good surgical performance. Fifteen detailed chapters on the use of surgical instruments were written. A typical chapter described the purpose of the instrument, its limitations, and the necessary equipment to perform exercises with the instrument. A pre-test, practice session, and post-test were described so that an individual could be tested on his performance. Slides and videotapes showing how to use the instruments were made. The intent was to duplicate and distribute these materials, but this was not done, and the materials were never made available.

The task force tried to learn about the use of a psychomotor skills laboratory and attempted to delineate the components of orthopaedic tasks. They found this to be a monumental effort, particularly in attempting to translate this information into a complete and sequenced curriculum. Out of this effort came descriptions of a plaster, traction, and surgical skills laboratory each with its own instructor and resident manual. Eventually the study ran out of money and, as indicated above, the results of the developmental work were never distributed. The hope was that this effort would produce a description of the essential components of the graduating orthopaedic resident. However, there was no consensus among the members of the task force about what constituted the ideal resident. Another difficulty was the overemphasis on instruments alone. Residents wanted to get on with learning procedures and were not receptive to the amount of time directed at instrument familiarization.

In 1968, the basic course for orthopaedic educators was formalized. Although one was offered in Florida earlier, the conceptual foundations for the present educator's course were first developed under the direction of Bill Griffith in Chicago. In 1971, Miller (16) published in *Clinical Orthopaedics* a description of the principles of resident education and Kopta (16) published a description of his observations on operating room performance. By 1974, Lippert, in the Department of Orthopaedics at the University of Washington, had developed and reported on a one-semester course in motor skills for 20 orthopaedic residents (17). He

recognized that specific motor acts needed to accomplish a procedure may be complex or relatively simple. The procedure may be difficult either because of special knowledge required or because of the technical factors. Therefore, the psychomotor challenge could be primarily cognitive or motor. The course was divided into basic and advanced skills, and out of the experience came further ideas and direction for continued development of the laboratory concept in developing psychomotor skills. At this point, both authors began collaborating extensively under the auspices of the American Academy of Orthopaedic Surgeons through the Basic Course for Orthopaedic Educators. Farmer was course director and Lippert a faculty member who became course chairman in 1978. The course provided the testing ground for evaluating new ideas, field testing them throughout the year, and adding the new information to subsequent course material. In 1976, the experience gained at the University of Washington in teaching psychomotor skills was introduced at the Educator's Course. Dr. David Murray as representative from the Committee on Graduate Education of the Academy attended the Educator's Course and found the concepts relating to teaching surgical skills in agreement with his own convictions regarding the value of laboratory psychomotor skills training. He organized an American Academy of Orthopaedic Surgeons Committee meeting in Seattle in 1976 to consider possible ways for further development. From that meeting came the determination to develop a course for orthopaedic psychomotor skill educators, a laboratory manual to assist in the development of psychomotor laboratories, and various means of testing psychomotor skills. In 1977, the Summer Institute featured a course in total knee replacement, developed by Dr. Murray in conjunction with Dr. Lippert, at which time a variety of total knee replacements were inserted under laboratory conditions. Hardware store tools, carpenter vices C-clamped to rickety tables, and simulated bones were used. Many technical difficulties with that setup were encountered, but participant enthusiasm for the concept was high and constituted strong encouragement to continue. In 1978, a workshop under the direction of Dr. Murray was convened in Syracuse, New York to consider the whole area of psychomotor skills and the directions which this emerging interest should take. From this meeting came the idea to develop a handbook describing in detail psychomotor curricula, instruments, and procedures which every resident, indeed every orthopaedic surgeon, should be able to do. Another task was to write a list of objectives describing psychomotor performance.

Meanwhile, interest had developed in testing at the board level for psychomotor competence. A subcommittee on testing was formed under the direction of Dr. Herbert Louis to consider the use of a single test for psychomotor competence. The test selected was correction of a femoral malunion. Dr. Lippert presented the test to the subcommittee, and it was decided to conduct a field experiment in Philadelphia in 1978 on six residency programs. The study was conducted at the Jefferson Medical School with the cooperation of Department Chairman John Gartland

and one of his senior faculty members, Dr. Jerry Cotler. The raters were drawn from orthopaedic faculty around the city. Two observers rated each resident. The study was directed by Dr. Lewis with the help of Drs. Lippert and Briggs who developed the test. Results were graded by the National Boards. The key problem was whether the inter-rater reliability was high enough to make valid judgments. A Cohen's kappa coefficient was chosen as the best statistical method to assess reliability. The outcome was considered to be good enough to discriminate the psychomotor-deficient performer from the rest of the group. This test was at least as discriminating as the interpretive skills exams used by the American Board of Orthopaedic Surgery. Therefore, the board elected to try a pilot study at the board exams in September of 1979. The same femoral malunion and hardware store tools were used for performing the corrective osteotomy. About 70 volunteers took the examination after the raters had themselves performed the osteotomy the day before and learned how to grade the results. The volunteer applicants were evaluated for problem solving, technical performance, and the quality of the end result. The reaction to this test was extremely hostile, and the inter-rater reliability was not high enough to reach a valid decision about the applicants' surgical performance. After much discussion, it was believed that further psychomotor skills testing was not appropriate at the board level.

The need for an Academy committee to develop and monitor psychomotor activities was recognized, and Dr. Murray sponsored the initiation of the Psychomotor Skills Committee with the first chairman being Dr. Lippert (18). The purpose of that committee was to guide the Academy on matters relating to psychomotor skills and to aid in the development of psychomotor skills laboratories by interested residency programs. A psychomotor skills course for individuals assigned this responsibility was held in Little Rock that April. At the same time, the first psychomotor skills laboratory manual was printed. Many of the participants at the first course were skeptical. Some had been sent by their chairmen to find out what was happening. Curiosity and interest were high, and the course spawned the development of numerous laboratories throughout the country. Since then, four psychomotor skills educator's courses have been held. Meanwhile, the Summer Institute provided a testing ground for further development of the laboratory in conjunction with courses such as the total knee course. Concepts learned in this course were used by other course chairmen so that, over the next few years, additional courses were presented having psychomotor components. Academy fellows expressed a desire for more courses with a hands-on laboratory.

The Committee on Psychomotor Skills recognized the logistical challenge of providing equipment, consultation, and expertise to various parts of the country. Already, laboratory equipment was being sequestered in various locations around the country with considerable expense and no central coordination. The Committee on Psychomotor Skills developed the idea of a central provider and logistical coordinator. The central