

[研究報告要旨]

眼科で行われる手術は顕微鏡を用いたマイクロサージャリーが基本である。すなわち座位姿勢で顕微鏡を覗きながら両手足を動かして機械を操作するという複雑な動作を術者が強いられる。顕微鏡手術の歴史は長いものの、施術者の姿勢や肉体的疲労について科学的な検討を試みた研究はない。我々は「顕微鏡手術に求められる疲労の少ない理想的な姿勢」を追求するために、人間工学的アプローチによって、顕微鏡手術執刀医の作業姿勢について検討を行った。

産業医科大学病院で3名の眼科医が硝子体手術を執刀した。術中の姿勢を4つの客観的な測定方法で調べた。すなわち、体圧分布測定、骨盤傾斜角度計測、椅子の二つの肘置きの利用（接触）頻度（利用時間）および側面からみた術者の姿勢評価（ビデオ動画撮影）である。術前後に疲労に関するアンケート調査を執刀医に対して行った。

調査結果によれば、体圧分布は、執刀医によって異なる分布を示した。しかし、坐骨結節にかかる圧力は全ての執刀医で体圧センサーの最大値 **256mmHg** を常に超えていた。骨盤傾斜角度は、**-11.7~15.0度**と執刀医間で差があるものの、比較的負担の少ない姿勢で手術を行っていた。肘置きへの接触については、症例の難易度によって接触の頻度に違いがあることが明らかとなった。肘置きを使用しない執刀医があり、肘置きを使うことに慣れていないため使わないと考えられた。今回の検討からは、肘置きを使った方が安定した手術姿勢が得られることがわかった。肘置き未使用者には、使用した方が安定した手術が出来る事を体感してもらおうが望ましいと思われた。このようなより望ましい姿勢の追求が、手術のパフォーマンス向上につながると思われる。

ビデオ撮影動画を用い、手術中の執刀医の姿勢を7つに分類する事が可能であった。疲労アンケート調査では、多くの執刀医が目、首、肩、腰、臀部、大腿に疲労を感じている事がわかり、他の計測結果と整合性があった。

今回の調査により、眼科顕微鏡手術は、執刀医の臀部への負荷が強い作業姿勢である事がわかった。執刀医に対する適度な姿勢変換や姿勢調整（座り方）に関する注意の喚起や、椅子の改善が望ましいと考えられた。臀部への負担軽減対策の一環として、眼科術者用椅子の改良品を試作したところ、従来椅子と比べ接触面積が広がり、平均圧力の減少につながる事がわかった。

手術姿勢は、施術者により大いに異なる。これには施術者の経た教育や経験、さらに使用する手術機材の違いが反映されている。今回この点を調査して、作業姿勢が手術パフォーマンスに及ぼす影響を明らかにした。

A Study on Working Postures of Microsurgeons

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Abstract

Ophthalmic surgeries are conducted essentially based on microsurgery techniques. Surgeons are forced to perform such complicated actions as to operate machinery by moving their both limbs while taking seated postures with their eye being kept to look into a microscope. While it has been many years since the microsurgeries become established, there has been no research on a study on working postures or physical fatigues of surgeons. We investigated working postures of microsurgeons through an ergonomic approach in an attempt to pursue "such an ideal posture to cope with a microsurgery as brings a less fatigue."

Three surgeons conducted vitreous surgeries at the Hospital of University of Occupational and Environmental Health Japan. Their working postures were investigated by means of the following 4 types of objective methods: measurement of body pressure distribution, measurement of pelvic tilt angle, the status of a contact of surgeon's both elbows on two elbow-rests of the chair by a newly developed automated detecting system and videography capturing a posture from a lateral view. Questionnaire surveys on the degrees of fatigue were conducted on the surgeons before and after the surgery.

The surveys showed that body pressure distributions varied depending on surgeons

involved, while pressures on the ischial tuberosity of all the surgeons exceeded the value of 256mmHg that is the maximum value of the pressure sensor. The pelvic tilt angles ranged from -11.7 to -15.0 degrees showing variance among surgeons, although they were seen to take such postures during the surgery as posed relatively less physical burdens. In terms of surgeon' s elbow contact on the elbow-rest, the contact rate was quantified by means of the automated elbow-contact sensing system. Its usefulness was affirmed. Different levels of difficulty level was clearly reflected on variance in the contact level. A less experienced surgeon tended to use the elbow-rest less frequently by reason of their unfamiliarity. We have a plan to hereafter suggest them to use the elbow-rest, leading to their self-awareness of its benefit for more reliable surgery. Education on the working postures can lead to an improved performance of the surgeries.

Based on the analysis of the dynamic images by video recording, the working postures of the surgeons were successfully divided into 7 types. The questionnaire surveys on fatigue showed that surgeons tended to develop feelings of fatigue on eyes, neck, shoulders, lumbar, buttocks, and thighs. This fact correlated positively with other measured results.

The investigation this time revealed that an ophthalmic microsurgery forces a surgeon in attendance to take a working posture that imposes a burden on his or her buttocks. Hence, it was necessary to advise those surgeons to regularly change their seating postures and to train them on how to adjust them (ways of seating) along with improvement of chairs used for the particular purpose. As one of the measures for lowering burdens on the buttocks, a trial version of chair to be used by ophthalmic surgeons was developed and evaluated. It came to light that, compared with a conventional chair, a wider area was contacted by the buttocks on the chair, resulting in a decreased average pressure.

Working postures of surgeons during operations vary greatly from surgeon to surgeon. This fact derives from the difference in educational career and experience of surgeons as well as in preference of equipment for surgery operations. This research investigated this state of things, clarifying the impact of working postures on surgical performance.