INTRODUCTION

“Ergonomics” is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system and the profession that applies theoretical principles, data and methods to design to optimize human well being and overall system (International Ergonomics Association, 2000).[1] The word ergonomics comes from two Greek words “ ergo” meaning work; “nomos” meaning law. Ergonomics is a system-oriented discipline, which now applies to all aspect of human activity. The subject is synonymous with ‘human factors engineering’ (HFE), a term more used in North America. Its fundamental importance is recognized in the International Labor Organization, which defines ergonomics as: “The application of the human biological sciences in conjunction with the engineering sciences to the worker and his working environment, so as to obtain maximum satisfaction for the worker which at the same time enhances productivity”. This definition emphasizes the important triad of ergonomic elements: Comfort, health and productivity.[2]

World War II prompted greater interest in human-machine interactions. The ergonomics application that started primarily in the military, has now expanded into most industries including health care and its allied branches. Thus better understanding of laboratory ergonomics requires study of anthropometry, biomechanics, mechanical engineering, industrial engineering and design, kinesiology, physiology and psychology as well as design considerations of work station, work surfaces and work positions.

NEED OF ERGONOMICS IN ORAL PATHOLOGY LABORATORY

A basic Pathology laboratory design includes designing of work surfaces such as bench tops, cabinets with locks, counters, walls, doors, windows, flooring, sinks, chemical/ waste storage, furniture design, exit paths, illumination, noise control and security. In an average diagnostic Pathology laboratory, the scenario for incorporating ergonomic principles varies. Large fully functional Pathology laboratories are aware of ergonomic principles and efforts have been made to adhere to them. In other cases, there is simple plain disregard for this science. Various causes attributed for this apathy are:

- Lack of funds and grants
- Lack of knowledge, awareness and know-how
- Substantially less work-load
- Casual approach to MSD prevention for personnel
- Lack of advanced instrumentation or automated machines, or primitive laboratory setup.

ABSTRACT

Ergonomics is simply a science focused on “study of work” to reduce fatigue and discomfort through product design. A comprehensive ergonomics program for the pathology laboratory has become necessary to prevent the occurrence of work related musculoskeletal disorders (MSDs) and accidents. Most of the literature on ergonomics involve various web links or occasional studies on the effect of laboratory work and associated MSDs. A Google search was carried out corresponding to the terms “ergonomics”, “pathology laboratory”, “microscope”. All the relevant literature from web sources was sorted out and categorized. In this review, we intend to identify basic anthropometric factors, biomechanical risk factors, laboratory design considerations and specific microscopy-related considerations. The ultimate aim of ergonomics is to provide a safe environment for laboratory personnel to conduct their work and to allow maximum flexibility for safe research use.

Key words: Ergonomics, microscopy, pathology laboratory, work position
The scene is still worse in Oral Pathology, where essentially most of the work done pertains to oral histopathology, hematology, oral cytology, with some amount of oral microbiology work. The amount of workload varies according to the dental hospital’s outdoor patients and specialist work done in Department of Oral Medicine and Oral Surgery. A huge effort for understanding and implementing the ergonomics principles is necessary.

A mismatch between the physical capacity of workers and the physical demands of their jobs can result in MSDs.[3] The pattern of musculoskeletal disorders found in epidemiological surveys of people working with microscopes is highly related to the special situation of the non-ergonomic microscope workstation leading to increasing muscle strain, fatigue and pain with sustained work. After a certain period of working in an awkward posture, not only does pain occur much earlier, but remains even during rest times.[4] In addition to musculoskeletal symptoms, microscope work may affect vision, including eyestrain and visual changes.

Herein, we intend to identify basic anthropometric factors, biomechanical risk factors and laboratory design considerations pertaining to incorporating ergonomic principles in actual practice. Also specific microscopy-related considerations have been discussed.

SEARCH STRATEGY

A PubMed/Medline search conducted on terms “ERGONOMICS”, “ORAL PATHOLOGY LABORATORY” and HUMAN FACTORS was done. No article exactly fitted to the needs and necessity of ergonomics requirements of a fully functional oral pathology laboratory setup. Most of the literature on ergonomics involves various web links or occasional studies on the effect of laboratory work and associated MSDs.

Eventually a Google search was carried out corresponding to the terms “ergonomics”, “pathology laboratory”, “microscope”. All the relevant literature from web sources was sorted out and categorized.

ANTHROPOMETRIC CONSIDERATIONS

Anthropometrics \{anthro (human), metric (measurements)\} is the scientific study of human body dimensions, shapes, weights and strengths.[5] Anthropometry measures the range of body sizes in a population considering gender, ethnic differences and certain physical disabilities. Anthropometric dimensions for each population is ranked by size and described as percentiles. It is common practice to design for the 5th percentile female to 95th percentile male.[6]

In anthropometric consideration, neutral posture/position (NP) is the most important thing to remember when working in the lab (or in any other situation). The rest of “ergonomics” is simply a means to achieve this posture. “Neutral position” means that the body is under the least amount of strain and is in a comfortable position. The forces of gravity and the compression of nerves, blood vessels, tendons and muscles cause permanent damage in our bodies. NP prevents this damage. The following are the guidelines to achieve NP:

- Ears over the shoulders
- Shoulders in line with the hips
- Forearms 90° angle or more from the upper arms
- Wrists straight (not bent, angled, or twisted)
- Heads relaxed
- Elbows hanging close to the sides
- Head is balanced on spinal column not tilted or rotated to any side.[7]

It is important to work in natural or neutral postures, which are near the midpoint of the full range of motion, where the muscles surrounding a joint are equally balanced and relaxed. The more a joint deviates from the neutral position, the greater the risk of injury.[5]

S-shaped spine

The spine naturally assumes an S-shaped curve. The upper spine (thoracic region) is bent gently out and the lower spine (lumbar region) is bent gently in. These bends are called kyphosis and lordosis, respectively. In NP, the spine is not rotated or twisted to left or right and it is not bent to left or right. Whether sitting or standing, the trunk does not bend forward (flexion) or backward (extension) by much.[8]

Four pillars of ergonomics have been described for optimizing performance of a computer-based workstation which are: Support, reach, breathing and vision. When all four pillars are accommodated, the user can work in complete comfort for maximized performance and productivity.[9]

REACH ZONE OR COMFORT ZONE

Arrangement of work surface area to suit the type and frequency of work is determined by comfortable reach zones, both horizontally and vertically.[5] Proper work placements reduce MSDs and increases operator efficiency. These proper areas are horizontally divided into:

- Zone 1: Primary Work Zone: Directly in front, objects easily reached by pivoting elbows (forearm swing space), in comfortable field of vision, maintenance of NP, greatest strength dexterity and visual acuity, for fine detailed work, contains objects most commonly used (repetitive access)
- Zone 2: Secondary Work Zone: Requires arm extension, within comfortable field of vision (approximately 25 inches from eye), do not require fine attention, holds objects that are used less often (occasional access)
• Zone 3: Tertiary Work Zone: Requires full arm and trunk movement, holds objects that are infrequently used (seldom access).

Working positions

Proper working positions contribute to the physical well-being of a worker. The common working positions are sitting, sit/stand and standing. The various types of laboratory work done in Oral Pathology and general working positions used are enumerated in Table 1.

Sitting

Sitting is work for human spine and musculoskeletal system and proper seating is an extremely important ergonomic consideration. The ideal position for sitting at work exists when there is a slight curve in the lumbar region of the back, as is found in the standing position. The worker’s shoulders should be relaxed, with the upper arms hanging down loosely. During work, the neck should not be bent too much. Sitting position is used when:

• Working for an extended time in fixed position
• Working with hands less than 6 inches above counter height
• Writing or precise work
• Stability or equilibrium is required.

The chair must be properly selected and customized to first properly fit, stabilize and support the lower back (lumbar region) of the worker. Chair design should allow freedom of movement, fit to task and into the work area. Use of foot rest is also advised.

Sit/Stand

This is an alternative seating to standing or sitting for an entire work shift. It allows the operator to alternate standing and sitting positions, thereby allowing the worker with lower back or hip problems to take weight off back and legs. Operators may be able to stand or lean comfortably for long periods of time, while protecting the lower limbs and back from excessive strain. Sit/stand also allows a greater range of motion for workers who handle large objects. A sit/stand position is used when:

• Getting up and down from a sitting position is hard on the body
• Repeatedly reaching with an extended arm
• Performing tasks that require prolonged static effort.

Standing

Standing is a great relief from fatigue caused by sitting. A standing position is used when:

• Mobility is required
• Knee clearance is unavailable
• Reaching high, low, or extended
• Exerting downward forces
• Lifting more than 10 pounds.[5]

Design considerations

Workbench setup (working surface height)

A well-designed workstation is important for preventing diseases related to poor working conditions, as well as for ensuring that work is productive. Every work station should be designed with both the worker and the task in mind as well as allow the worker to maintain a correct and comfortable body posture.[11] Most lab workbenches are of fixed heights. Working at a bench that is the wrong height causes many risk factors for MSDs including neck, shoulder and back strain. A workstation evaluation helps to determine the correct height for surface with type of work position, chair/foot rest to be used. Workbenches should be at the following heights based on the guidelines suggested by the National Institute of Occupational Safety and Health (NIOSH).[12]

• Precision work - Workbench should be above elbow height
• Light work - Workbench should be just below elbow height
• Heavy work - Workbench should be 4-5 inches below elbow height
• Note: The elbow height is the distance from the floor to the elbow [Figure 1].

Kroemer and Grandjean (1997) have discussed in detail about the desk heights for sitting and standing operator, depending on whether the desk is for precision, light or heavy work. Desk height for a standing operator can range from 28-31 inches.[13]

Chairs

A chair that is well-designed and appropriately adjusted is an essential element of a safe and productive computer workstation. A good chair provides necessary support to the back, legs, buttocks and arms, while reducing exposures to awkward postures, contact stress and forceful exertions.

Table 1: The various types of laboratory work done in oral pathology and general working positions used

| Type of laboratory work          | Working position |
|----------------------------------|------------------|
| Grossing                         | Sit/stand        |
| Cassette labeling                | Sit/stand        |
| Changing solutions in processor  | Standing         |
| Embedding                        | Sitting          |
| Manual microtomy                 | Sit/stand        |
| Cryotomy                         | Sit/stand        |
| Manual staining                  | Standing         |
| Manual coverslipping             | Sit/stand        |
| Slide labeling                   | Sit/stand        |
| Pipetting                        | Sitting          |
| Microscopy                       | Sitting          |
| Computer operations              | Sitting          |
Seat Height: Seat height should be pneumatically adjusted while seated. A range of 16-20.5 inches off the floor should accommodate most users. Thighs should be horizontal, lower legs vertical, feet flat on the floor or on a footrest. Seat height should also allow a 90° angle at the elbows for typing.

Seat Width and Depth: A seat width of 17-20 inches suffices most of the people and should be deep enough to permit the back to contact the lumbar backrest without cutting into the backs of knees. The front edge should be rounded and padded. The seat slant should be adjustable (0 to 10°). Avoid bucket-type seats. The seat should swivel easily.

Backrest: The backrest should offer firm support, especially in the lumbar (lower back) region, should be 12-19 inches wide and should be easily adjustable, both in angle and in height, while sitting. The optimum angle between seat and back should permit a working posture of at least 90° between the spine and thighs. Seat pan angle and backrest height and angle should be coordinated to allow for the most comfortable weight load on the spinal column.

Seat Material: A chair seat and back should be padded enough to allow comfortable circulation. If a seat is too soft, the muscles must always adjust to maintain a steady posture, causing strain and fatigue. The seat fabric should “breathe” to allow air circulation through clothes to the skin.

Armrests: Armrests are optional, depending on user preference and task performed. They should not restrict movement or impede the worker’s ability to get close enough to the work surface. The worker should not rest his or her forearms while keying.[14]

BIOMECHANICAL RISK FACTORS

Biomechanical considerations are particularly useful in histopathology, since every task is repetitive and many of these tasks require force and are performed in awkward positions. Table 2 enumerates the various tasks in the Oral Pathology Laboratory and their associated biomechanical risk factors. Biomechanical risk factors include exposure to excessive force static and awkward posture, repetitive movements and vibrations, cold temperatures and contact stress. The risk factors are characterized by their frequency, repetition, duty cycle and duration of exposure. These risk factors are important when selecting equipment, tools and justifying the need for automation.[5] Also prolonged exposure to ergonomic risk factors can cause damage to a workers’ body and lead to MSDs.[15]

Specific Work Considerations: Basic Microscope Ergonomics

Microscopy is backbone to Oral Pathology. It is a common sight to see a standard microscope set on top of a pile of books to improve the sitting posture on a standard office chair. Microscope operators are forced into an unusual exacting position, with little possibility to move the head or the body. Centers for Disease Control and Prevention (1997) reported that workers using microscopes are at risk of injury to the upper extremities, neck and back because of the nature of their work. Microscope and laboratory workers stand for prolonged periods of time, perform tasks with awkward posturing, look downward while performing eye-straining tasks for prolonged periods of time and carry out fine manipulation activities that require the use of flexor and extensor muscles of the fingers and wrist. The potential for injury is compounded by the increase in time, the workers spend at their workstations.[16] Microscopes that could be

| Table 2: Biomechanical risk factors and various tasks involved in oral pathology laboratory |
|---------------------------------------------------------------|
| **Biomechanical risk factor** | **Task in laboratory** |
| Repetition | Computer data entry |
| | Manual cassette and slide labeling |
| | Embedding |
| | Microtomy and cryomicrotomy |
| | Staining |
| | Pipetting |
| | Coverslipping |
| | Microscopy |
| Force | Opening specimen containers/vials/cassettes/lids |
| | Pipetting |
| | Microtomy |
| Awkward and static working postures | Repeated or prolonged reaching |
| | Bending, twisting |
| | Grasping objects |
| | Sitting for long periods |
| | Microscopy |
| | Standing for long periods |
| | Using biological safety cabinets/fumehoods |
| Exposure to cold temperature | Cryomicrotomy |
| Contact stress | Pipetting/liquid handling, microtome |

Figure 1: Standard standing workbench heights according to various types of work involved
adapted to an individual user, rather than forcing the user to adapt to the microscope, were more comfortable and caused fewer problems.\cite{17}

From the viewpoint of biomechanics, having to maintain even a slight incline of 30° from the vertical can produce significant muscle contractions, muscle fatigue and pain. In fact, it has been documented that nerves can often be pinched when the neck is overextended by this amount. Repetitive motions of the hands and the contact stress of arms resting on a hard surface can cause pain and nerve injury, leading to repetitive stress injuries and/or carpal tunnel syndrome.\cite{18}

To permit a more neutral erect working posture, the optical path (distance from the ocular lenses to the specimen being viewed) should range between 45 and 55 cms (18 to 21.5”). The eyepieces should be no more than 30° above the horizontal plane of the desktop. A majority of older microscopes, however, have much shorter optical path dimensions (25 to 30 cm or 10 to 12”) with the eyepieces angled at 60° above horizontal. This configuration creates a dilemma for the user. If the microscope is raised to a sufficient height to prevent neck flexion, then the user is forced to bend the wrists into an unnatural position. If the microscope is lowered to bring the stage to a more neutral position, with the forearm parallel to the floor, then the neck is forced to bend [Figure 2]. Most workers compensate for this by finding some “happy medium” between the two extreme postures, resulting in discomfort for the neck, shoulders, forearms, wrists and hands.\cite{19} Many of the eyestrain problems that develop during extended periods of microscope use.

During the 1980s and 90s, microscope manufacturers had began introducing ergonomic features into their instruments to make them safer and more comfortable to use for extended periods of time, up to six or eight hours a day.\cite{20} Extensive studies of how users sit at their instruments, measurements of convenient reaching distances and determinations of comfortable arm and head positions have revolutionized the microscope and its workstation design. An ideal microscopy workstation has been presented in Figure 3. An ergonomic laboratory microscope of compact design and minimal depth, is positioned along with a pair of sloping armrests\cite{21} that eliminate the necessity to remove the arms from the workbench to adjust the microscope as well as help in proper arm position to manipulate the low stage and focus levels. A microscope organization station\cite{22} has also been incorporated along with easy access to

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image1.png}
\caption{An ideal microscopy workstation consisting of a microscope with photomicrography attachments, armrests, computer and a microscope organization station}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image2.png}
\caption{Ideal body posture for viewing a microscope: An upright comfortable posture with operator spine and arms correctly aligned for long observation periods (center). Ergonomically awkward adaptation of body posture when viewing height is high (a) or low (b)}
\end{figure}
photomicrography digital camera controls, computer and keyboard.

The new microscope ergonomic designs involve operator control, posture boundaries, ocular/eye-level adjustments (height and angle), stage placement and instrument body and stand rigidity and specimen handling. These ergonomic advances for microscope [Figure 4] include:

- Tilting, swinging and telescopic eyepiece tubes
- Optional eye-level riser tubes and wedge that place the eyepieces closer to a horizontal angle
- Observation tube height extender
- Lowered single-hand focus controls
- One-handed stage (positioning the stage handle and focus control knobs in an equidistant configuration from operator)
- Refocusing stopper
- In-line focusing
- Motorized objectives changeover
- Microscope positioners
- For countering eye strain/fatigue-diopter adjustments, high eye point eyepieces, video camera systems with charge coupled device (CCD) or complementary metal oxide semiconductor (CMOS) sensor that display the specimen on a computer monitor can be used. Eyestrain will be minimized when peering into the microscope eyepieces with relaxed eyes (similar to observing a subject at a large distance). The ‘20-20-20 rule’ that states for every 20 minutes look 20 feet away for 20 seconds and blink 20 times is advocated.

In the new ergonomic designs, the most frequently used controls are put in the most convenient places for the microscopist, regardless of the ease of manufacturing. Controls used in conjunction with each other, such as stage movement, fine focus and brightness control, have been placed where they can be adjusted with the fingers of the same hand. With forearms resting comfortably on the desktop, the most often used controls fall naturally under the fingertips. A much lower position of the stage makes slide changing convenient. Stage controls can be mounted on either side for left- or right-hand operation. The three main adjustment elements: Focus controls, stage controls and brightness control are within reach of the user’s hand [Figure 5].

For ergonomically modifying a traditional microscope some of the new aftermarket ergonomic adjustment products are with respect to microscope posture and positioners, eyepiece/observation tubes, stages and controls, armrests, arm supports (ergonomic sloping arm supports and wrist servers) microscope organization station and table, extended eye tube optical wedges (provide greater viewing angle range between 5º to 25º), observation or body tube height extender (increases distance between eyepieces and stage adjustments).

A microscope table plays a major role for the microscope oculars to be used at the correct height. An ergonomic table allows the microscope to be used with the head in an upright position, the forearms supported and with less flexion of the upper arm. Characteristics for an ergonomic microscope table are:

- Stable
- Adjustable in height (crank, electrical etc.)
- Sufficient amount of space (manual, counter)
- Cut-away section at the front of the table (sitting near the microscope, arm support)

![Figure 4: New ergonomic advances for microscopes: Swinging eyepiece tube (a), rotating & swinging eyepiece tube (b), extended eyepiece tube (c), eye-level riser (d), wedge (e), microscope positioner (f)]
A realistic approach should be taken in assessment of microscope work. Activities to develop and improve microscope work should not only be directed towards the ergonomics of the workstations and the methods used, but also towards the microscopes. Nor should the training and work guidance of microscopists be forgotten. Technological advancements have produced a new perspective to the development of microscope work.

CONCLUSION

Microscope work is strenuous, both to the visual system as well as to the musculoskeletal system. Although many of the ergonomic requirements are now being addressed by microscope manufacturers, there are a considerable number of microscopes “in the field” that are poorly equipped to provide worker comfort and reduce the incidence of injuries. Over time, these microscopes will be replaced with modern, ergonomic-friendly versions, but in the meantime, employers should be concerned about potential medical problems that may arise from extended microscope use.[10] If basic ergonomic principles are followed during the creation of microscope workstations, MSDs are less likely to arise. In the short-term aftermarket accessories that are available for a wide spectrum of microscopes, may be the answer for a majority of older instruments. However, the end result should be a definitive shift to microscopes designed to optimize both operator safety and comfort, while providing the latest features in regard to optical quality and performance. Ergonomics is a subjective science; its requisites vary according to each operator individually. Designing a laboratory that suits each operator might not be financially possible but adhering to the basic ergonomic principles will definitely increase the efficiency and efficacy of the operator in his or her work place. More studies on the new design incorporations and their effects are to be done and encouraged. The ultimate aim of ergonomics is to provide a safe environment for laboratory personnel to conduct their work and to allow maximum flexibility for safe research use.

ACKNOWLEDGEMENT

We like to express our sincere gratitude to Dr. Uma Gupta, Professor and Head Department of Oral Pathology and Dr. Pradeep Jain, Principal, Government Dental College Jaipur for providing all the necessary facilities and resources for the completion of the review.

REFERENCES

1. Definition of ergonomics. Available from: www.iea.cc/01_what/What%20is%20Ergonomics.html [Last accessed on 2013 Sept 18].
2. Ergonomics. Available from: www.medicine.man.ac.uk/ oeh/undergraduate/onlineressources/ergonomics [Last accessed on 2013 Sept 18].
3. Basic Ergonomics. Doug Elizondo. QA 515. Electronic Assemble Ergonomics, Nov 2005. Available from: Jcounsel.com/msqa/term_papers/electronics_assembly_ergonomics.pdf [Last accessed on 2013 Sept 19].
4. Kreczy A, Kofler M, Gschwendtner A. Underestimated health hazard: Proposal for an ergonomic microscope workstation. Lancet 1999;354:1701-2.
5. Mislew JJ. Ergonomics. In: Bancroft JD, Gamble M, editors. Theory and Practice of Histological Techniques. 6th edition. Philadelphia: Churchill Livingstone; 2008. p. 661.
6. Ergonomics and Design, A Reference Guide; Scott Openshaw, Erin Taylor. Available from: Cms.allsteelofficce.com/SynergyDocuments/Ergonomics And Design Reference Guide White Paper. pdf [Last accessed on 2013 Sept 19].
7. Laboratory Ergonomics: Risk factors and workbench assessment; Tamara Mitchell Edited by Sally Longyear. Available from: www.workingwell.org/articles/pdf/Lab_Ergo.pdf [Last accessed on 2013 Sept 19].
8. Neutral Posture. Available from: www.oehc.uchc.edu/ergo_neutralposture.asp [Last accessed on 2013 Sept 19].
9. Available from: www.humanscale.com/form_function/fourpillars-video.cfm [Last accessed on 2013 Sept 19].
10. A Guide to Ergonomics; Berry C, MeNeely A, Beauregard K; N.C. Department of Labor, Occupational Safety and Health Program. Available from: www.ncalabor.com/osh/a/indguide/ig9.pdf [Last accessed on 2013 Sept 19].
11. Your health and safety at work. ERGONOMICS; International Labour Organisation. Available from: http://actrav.itcilo.org/actrav-english/telelearn/osh/ergo/ergonomi.htm. Sitting and chair design [Last accessed on 2013 Sept 19].
12. Elements of Ergonomic Programmes; DHHS (NIOSH) Publication no. 97-117, March 1997. Available from: www. cdc.gov/niosh/docs/97-117/pdfs/97-117.pdf [Last accessed on 2013 Sept 19].
13. Kroemer KHE, Grandjean E. Fitting the task to the human: A textbook of occupational ergonomics. 5th edition London: Taylor and Francis; 1997.p 60.
14. Ergonomic workstation guidelines. Available from: www.ncsu.edu/ehs/www99/right/handsMan/office/ergonomic.html [Last accessed on 2013 Sept 19].

15. Ergonomics: The Study of Work; U.S. Department of Labor Occupational Safety and Health Administration, OSHA 3125, 2000 (Revised). Available from: www.fop.org/downloads/OSHA%20Ergonomics.pdf [Last accessed on 2013 Sept 19].

16. Darragh AR, Harrison H, Kenny S. Effect of an ergonomics intervention on workstations of microscope workers. Am J Occup Ther 2008;62:61-9.

17. Ortiz D, Marcus M, Gerr F, Jones W, Cohen S. Measurement variability in upper extremity posture among VDT users. Appl Ergon 1997;28:139-43.

18. Proper Microscope Posture. Available from: www.microscopyu.com/tutorials/java/ergonomics/posture [Last accessed on 2013 Sept 19].

19. Available from: www.olympusmicro.com/primer/anatomy/ergonomics/ergointro.html [Last accessed on 2013 Sept 19].

20. Basic Microscope Ergonomics. Available from: http://www.microscopyu.com/articles/ergonomics/ergointro.html [Last accessed on 2013 Sept 19].

21. Available from: http://www.az-microscope.on.ca/ergonomics.htm [Last accessed on 2013 Sept 19].

22. Organization Station. Available from: http://www.marketlabinc.com/product.asp?strParents=1329,1330,1524 and CAT_ID=1527 and P_ID=3896 [Last accessed on 2013 Sept 19].

23. The ergonomic microscope for all laboratory applications. Available from: http://www.olympusamerica.com/seg_section/brochurefiles/664_bro.pdf [Last accessed on 2013 Sept 19].

24. Microscope Positioners and Adapters. Available from: http://ergonomics.ucr.edu/catalog_laboratory/microscopes.html [last accessed on 2013 Sept 19].

25. Eyestrain. Available from: http://www.mayoclinic.com/health/eyestrain/DS01084/DSECTION=prevention [Last accessed on 2013 Sept 19].

26. Available from: http://www.bayoptical.com [Last accessed on 2013 Sept 19].

27. Success is a question of attitude. Leica Microsystems. Available from: www.leica-microsystems.com/fileadmin/downloads/Leica%20MS5/Application%20Notes/Handbuch_ERGO_englischTeil1.pdf [Last accessed on 2013 Sept 19].

28. Sillanpaa J, Nyberg M, Laippala P. A new table for work with a microscope, a solution to ergonomic problems. Appl Ergon 2003;34:621-8.

How to cite this article: Sundaragiri KS, Shrivastava S, Sankhla B, Bhargava A. Ergonomics in an oral pathology laboratory: Back to basics in microscopy. J Oral Maxillofac Pathol 2014;18:103-10.

Source of Support: Nil. Conflict of Interest: None declared.