

## Head up, heels down, posture perfect: Ergonomics for an ophthalmologist

Every 10 seconds, a worker is temporarily or permanently disabled and some of them are physicians and surgeons. It is a well-known fact that medical professionals are prone to musculoskeletal disorders (MSDs), with ophthalmologists being particularly at a higher risk.<sup>[1,2]</sup> Common MSDs in ophthalmologists include disabling back pain, neck pain, numbness in the hands and legs, and carpal tunnel syndrome.<sup>[1,2]</sup> It may be hard to believe that most work-related disabilities in ophthalmologists are caused by simply doing the routine – performing a slit-lamp examination, using an indirect ophthalmoscope, or even sitting on a surgeon's chair.<sup>[1]</sup> Although these injuries are chronic in evolution, the effects can be devastating.

Here are some hard facts:

- A survey of 325 practicing ophthalmologists in the United Kingdom in 1994 found that 54% had significant back pain, with those longest in practice being worse affected.<sup>[3]</sup> This number seems to have risen to 64% according to a more recent study.<sup>[4]</sup> Significantly, 34% reported pain while operating, and 32% had pain while using a slit-lamp
- In a survey of 162 ophthalmologists in Iran, 80% reported chronic back pain and 55% had chronic headaches<sup>[5]</sup>
- A survey of American ophthalmologists in 2005 revealed that 52% of the 697 respondents reported neck, upper body, or lower back pain, with 15% having to curtail their work as a consequence.<sup>[6]</sup> Low back pain was present in 39% of respondents, followed by upper extremity symptoms (33%) and neck pain (33%)
- Two-thirds of ophthalmologists in Saudi Arabia had mild to moderate neck and upper back pain<sup>[7]</sup>
- This issue of Indian Journal of Ophthalmology carries the results of a survey among practicing Indian ophthalmologists, which pegs self-reported back pain at a concerning 71%<sup>[8]</sup>
- Vitreoretinal surgeons are specifically at a high risk of developing MSD.<sup>[9]</sup> As expected, among a large cohort of vitreoretinal surgeons, 55% reported both back and neck pain, and 7% required surgery to relieve their symptoms<sup>[1]</sup>
- Of 130 American ophthalmic plastic surgeons, 73% had pain associated while performing surgery; nine of them had to discontinue operating as consequence.<sup>[10]</sup>



**Figure 1:** Posture for slit-lamp evaluation. Ophthalmologist is slumping toward the slit-lamp with the neck extended, thus putting strain on the neck and back (left) - this is a wrong posture. Ophthalmologist has brought the slit-lamp forward and has adjusted the height to sit erect without having to lean forward or change the neck angle (right) - this is an ergonomically appropriate posture. (Adapted from <http://www.ophthalmologymanagement.com/issues/2012/january-2012/of-ophthalmologists-aching-backs>)<sup>[15]</sup>

**Table 1: Ergonomics for an ophthalmologist - risk factors and possible solutions**

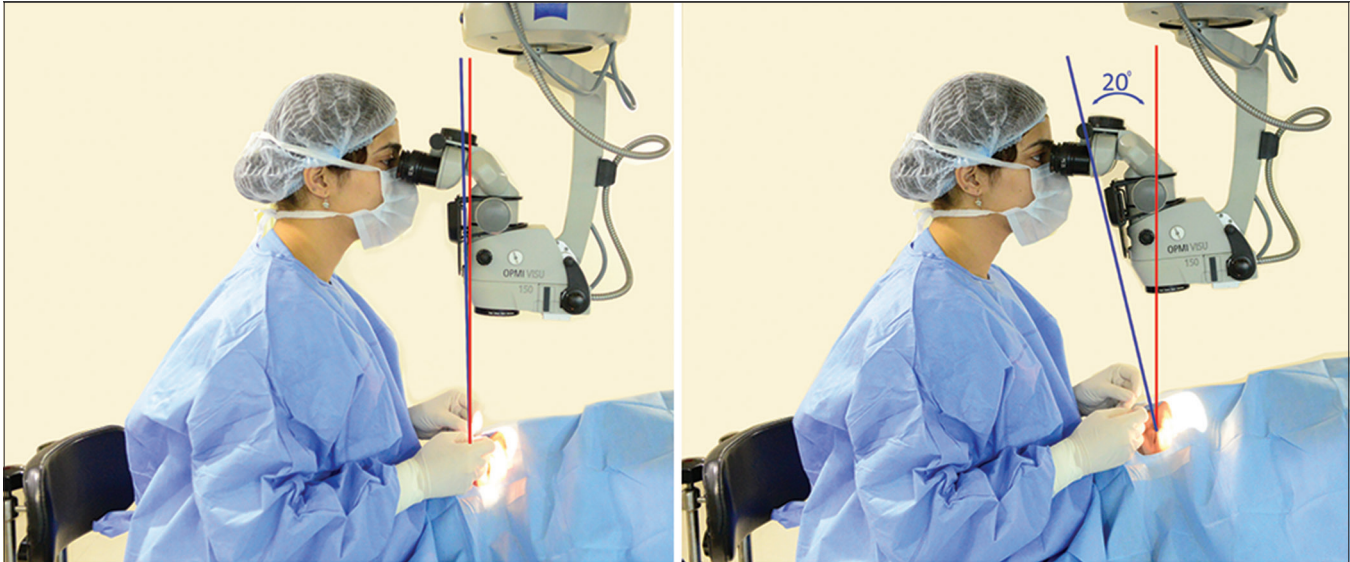
<b>I. Avoiding neck injuries: Repeated flexion or extension of the neck while at the slit lamp, operating microscope, or computer terminal can cause chronic pain and muscle spasms<sup>[13]</sup></b>	
<b>Risk factor</b>	<b>Solution</b>
<b>Slit lamp:</b> The head, neck, and torso should be ideally aligned vertically in a neutral posture, without the neck pushed forward or the head tilted down or up to view the monitor. However, slit lamps are commonly positioned on the examination table in such a way that the ophthalmologist must lean toward the instrument, pushing the neck out of alignment, and into extension repeatedly <sup>[13]</sup>	Modify the table to move the slit lamp closer to the examiner than the patient, or adjust the examination chair in such a way that the ophthalmologist does not have to lean forward [Fig. 1] <sup>[13]</sup>
<b>Operating microscope:</b> Operating microscopes are not always equipped with eyepieces that can be tilted for comfort. Even if seating and table heights can be adjusted optimally, the stationary eyepiece forces the neck into awkward flexion or extension for the duration of the surgery <sup>[13]</sup>	Invest on an adjustable eyepiece, and orient it in such a way that the surgeon can sit straight. Adjusting an angle of 20°-30° between the objective and the eye piece can easily accomplish it [Fig. 2]. <sup>[13]</sup> Heads-up visualization systems may alleviate this problem
<b>Indirect ophthalmoscope:</b> Indirect ophthalmoscopy entails a specific neck position for a prolonged period, in addition to weight on the head and some awkward neck and spine positions to peer through the pupil at a specific angle. Indirect ophthalmoscopy results in moderate flexion of the neck and overall spine, lateral bending of the back and overall spine, and rotation of the neck and overall spine. The neck is in moderate flexion and rotation approximately half of the time, and the overall spine is moderately flexed most of the time during indirect ophthalmoscopy <sup>[9]</sup>	Indirect ophthalmoscopes must be light weight. Rechargeable indirect ophthalmoscopes, although convenient, can be heavier than the conventional corded versions. Try and maintain neutral spine posture to the extent possible during indirect ophthalmoscopy by adjusting the height of the examination couch and the patient's head. Indirect ophthalmoscopy in sitting position is not hard to learn and can be used for routine screening
<b>Surgical loupe:</b> Surgical loupes used for squint and oculoplasty surgeries are conventionally heavy and require a fixed range of neck angulation. It can be taxing on the neck and back, especially with prolonged oculoplasty surgeries	Try light-weight prism-based ergonomic surgical loupes without an incorporated illumination system (which increases weight and compels a specific neck position) or shift to perform squint and oculoplasty surgeries using a microscope. Changing the microscope objective lens can easily provide a larger field of view and increase the working distance as is necessary for a squint or an oculoplasty surgery
<b>Computer:</b> The neck and shoulders can be strained when the head is tilted back to view a monitor, for example, with bifocal eyeglasses or if the arm is lifted away from your body to reach the mouse <sup>[13]</sup>	Do not wear bifocals that require extension of the neck to read through the lower segment. Instead get a bifocal where the upper segment is focused at the computer distance and the lower segment focused for the closer work on your desk or get used to progressive glasses. Place the mouse so that there is no need to lift your arm to reach it <sup>[13]</sup>
<b>II. Avoiding back injuries: Maintaining an unbalanced posture for long periods produces static loading of the soft tissues and ischemic accumulation of metabolites in them. This can accelerate disk degeneration and lead to disk herniation<sup>[13]</sup></b>	
<b>Risk factor</b>	<b>Solution</b>
<b>Improperly adjusted equipment in the operating room:</b> Surgeons sometimes neglect to adjust the chair and table to the proper height. During a series of surgeries, prolonged maintenance of the body in an odd position further magnifies the strain on the spinal muscles and tendons. This leads to overfatigued tissues, discomfort, and inflammation <sup>[13]</sup>	Do not commence surgery without first adjusting the seating, table, and equipment so that you can maintain a neutral spine, with normal curvature, throughout the procedure. Invest on a comfortable and hydraulically adjustable operating chair with good back support <sup>[13]</sup>
<b>Foot pedal:</b> Seated surgeons increase their risk of injury if they cannot reach the foot pedal without angling the thighs toward the floor. This makes it harder for the musculature to stabilize the spine <sup>[13]</sup>	If possible, lower the seat and table so that you can keep knees bent at 90°, feet flat on the floor and thighs parallel to the floor. This is the least stressful position for the lower back. If you cannot use the foot pedal without inclining the thighs, elevate the pedals by putting them on a sturdy rise <sup>[13]</sup>
<b>III. Avoiding arm and hand injuries: Extended periods of holding the bent arms too high, too low, or unsupported while with a patient, or entering data into a computer, can produce shoulder pain, carpal tunnel syndrome, tendinitis, and tenosynovitis. Repeatedly resting the elbows or forearms on a hard surface during procedures, or on malpositioned armrests, can lead to ulnar neuropathy<sup>[13]</sup></b>	
<b>Risk factor</b>	<b>Solution</b>
<b>Keyboard:</b> With the widespread implementation of electronic health records, physicians are spending more time typing on a computer keyboard. In addition to the risks from repetitive use of the keyboard, certain tasks require the exertion of concentrated force, during which hand and arm muscles must work continually, for example, when the mouse is so sensitive that the pointer is hard to control <sup>[13]</sup>	With every new terminal you encounter, adjust the chair, table, monitor, keyboard, and mouse to provide the best posture with the least amount of muscle strain <sup>[13]</sup>

**Table 1: Contd...**

**Contact stress:** Contact stress can cause tingling and numbness if a tendon, nerve, or blood vessel is stretched over a bone or tendon. Tendons can be damaged when repeated finger motions are performed with a bent wrist. The external version of this occurs when the forearms or wrists/palms come into contact with sharp edges on a working surface<sup>[13]</sup>

Do not lean forearms or elbows on unpadded surfaces. Keep palms, wrists, and forearms in a straight line, roughly parallel to the floor. Watch for sharp edges on accessories such as wrist rests<sup>[13]</sup>

Adapted from Ergonomics, Part Two: Seven Risk Factors and Seven Solutions, available at <https://www.aaopt.org/eyenet/article/ergonomics-part-two-seven-risk-factors-seven-solut>. [Last accessed on 2017 August 09]<sup>[13]</sup>



**Figure 2:** Posture for operating microscope. Microscope ocular and objective are at a straight line, with the ophthalmologist having to lean forward constantly (left) - this is a wrong posture. If the ocular is moved 20°–25° toward the surgeon and the operating chair height is appropriately adjusted, the surgeon can sit straight (right) - this is an ergonomically appropriate posture. (Adapted from <http://www.ophthalmologymanagement.com/issues/2012/january-2012/of-ophthalmologists-aching-backs>)<sup>[15]</sup>

It is evident that improper work ergonomics leads to disability, poor productivity, and early retirement.<sup>[11–15]</sup> The National Institute of Occupational Safety and Health has identified four factors influencing the development of MSDs: (1) environmental hazards, (2) human biologic factors, (3) behavioral factors or unhealthy lifestyles, and (4) inadequacies in existing health care.<sup>[11]</sup> The problem being multifactorial, intervention to minimize the risk must have a layered approach.

Physical strains directly associated with the ophthalmic profession including stress on the shoulders, neck, back, arms, and hands resulting from poor posture during examination and surgery as well as repetitive actions common to the surgical profession are some of the modifiable risk factors. One of the eminently modifiable situations is ergonomic redesigning of our individual work places. Ergonomics is the process of designing or arranging workplaces, products, and systems so that they suit the professionals who use them. This is in sharp contrast to the typical hospital design that assumes that one size fits all.

The American Academy of Ophthalmology recognized the problem early and set up a task force to address the issue. The task force offers an online course encompassing the best practices in work place ergonomics.<sup>[12–14]</sup> Experts have recommended essential work ergonomics to help alleviate MSDs faced by the ophthalmologists [Table 1 and Figs. 1 and 2].<sup>[13–15]</sup> Ergonomic intervention as detailed in Table 1, prophylactic neck and back exercises and timely professional consultation may help alleviate symptoms and maintain better work efficiency.<sup>[13,14]</sup> In a study of dentists undergoing an ergonomic makeover, a majority of them reported disappearance of their symptoms.<sup>[16]</sup> In that same study, the mean working hours and work efficiency reportedly improved.

About 50 years ago, Laufman was duly concerned that “only a few surgeons have made the surgical environment their main research interest.”<sup>[17,18]</sup> The situation has not changed much. Our efforts to create an ergonomic clinic and operating room environment will require paradigm changes in the traditional concepts of design to have customization built into standardized hospital architecture. Instrument manufacturers should be provided with user-driven information to optimize ergonomics and provide adjustability. A greater involvement in this transformation by the ophthalmologists themselves may help accomplish the twin goals of personal well-being and increased efficiency while maintaining patient and staff safety.

**Santosh G Honavar**

Editor, Indian Journal of Ophthalmology, Centre for Sight, Road No 2, Banjara Hills, Hyderabad 500034, India.

E-mail: editorjournal@aio.org

## References

1. Available from: <https://www.reviewofophthalmology.com/article/will-ophthalmology-cripple-you>. [Last accessed on 2017 Aug 09].
2. Natarajan S, Nair AG. Is ophthalmology becoming a pain in the neck? Indian J Ophthalmol 2016;64:413-4.
3. Chatterjee A, Ryan WG, Rosen ES. Back pain in ophthalmologists. Eye (Lond) 1994;8(Pt 4):473-4.
4. Hyer JN, Lee RM, Chowdhury HR, Smith HB, Dhital A, Khandwala M. National survey of back and neck pain amongst consultant ophthalmologists in the United Kingdom. Int Ophthalmol 2015;35:769-75.
5. Chams H, Mohammadi SF, Moayyeri A. Frequency and assortment of self-report occupational complaints among Iranian ophthalmologists: A preliminary survey. MedGenMed 2004;6:1.
6. Dhimitri KC, McGwin G Jr., McNeal SF, Lee P, Morse PA, Patterson M, et al. Symptoms of musculoskeletal disorders in ophthalmologists. Am J Ophthalmol 2005;139:179-81.
7. Al-Marwani Al-Juhani M, Khandekar R, Al-Harby M, Al-Hassan A, Edward DP. Neck and upper back pain among eye care professionals. Occup Med (Lond) 2015;65:753-7.
8. Venkatesh R, Kumar S. Back pain in ophthalmology: National survey of Indian ophthalmologists. Indian J Ophthalmol 2017;65:678-82.
9. Shaw C, Bourkiza R, Wickham L, Mccarthy I, Mckechnie C. Mechanical exposure of ophthalmic surgeons: A quantitative ergonomic evaluation of indirect ophthalmoscopy and slit-lamp biomicroscopy. Can J Ophthalmol 2017;52:302-7.
10. Sivak-Callcott JA, Diaz SR, Ducatman AM, Rosen CL, Nimbarte AD, Sedgeman JA. A survey study of occupational pain and injury in ophthalmic plastic surgeons. Ophthal Plast Reconstr Surg 2011;27:28-32.
11. Available from: <https://www.cdc.gov/niosh/index.htm>. [Last accessed on 2017 Aug 09].
12. Available from: <https://www.aao.org/course/ergonomics-best-practices-course>. [Last accessed on 2017 Aug 09].
13. Available from: <https://www.aao.org/eyenet/article/ergonomics-part-two-seven-risk-factors-seven-solut>. [Last accessed on 2017 Aug 09].
14. Available from: <https://www.aao.org/eyenet/article/ergonomics-part-one-is-job-you-love-pain-in-neck>. [Last accessed on 2017 Aug 09].
15. Available from: <http://www.ophthalmologymanagement.com/issues/2012/january-2012/of-ophthalmologists-aching-backs>. [Last accessed on 2017 Aug 09].
16. Droeze EH, Jonsson H. Evaluation of ergonomic interventions to reduce musculoskeletal disorders of dentists in the Netherlands. Work 2005;25:211-20.
17. Laufman H. What's wrong with our operating rooms? Am J Surg 1971;122:332-43.
18. Berguer R. Surgery and ergonomics. Arch Surg 1999;134:1011-6.

Access this article online	
<b>Quick Response Code:</b>	<b>Website:</b> www.ijo.in
	<b>DOI:</b> 10.4103/ijo.IJO_711_17

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**Cite this article as:** Honavar SG. Head up, heels down, posture perfect: Ergonomics for an ophthalmologist. Indian J Ophthalmol 2017;65:647-50.