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Enhancing Ergonomics and Workflow in Microdentistry: OPMI® pico with MORA Interface

Publication for the IDS 2005 by Assad F. Mora, DDS, MSD, FACP

The operating microscope has been an essential instrument in my private practice since 1992. Once I became "hooked" on the visual advantage provided by the microscope in my daily practice, I became more aware of the ergonomic shortcomings that occasionally made the microscope a difficult instrument to use.

In 1998, Friedman et al. reported that the microscope is unusable in certain areas of the mouth. In an effort to make the microscope more user-friendly, one must first understand how the traditional microscope is positioned for use in dentistry. The traditional microscope is positioned to facilitate the seating of the operator between the 9 and 11 o'clock positions, the same position used by right-handed dentists who don't use a microscope in their practice. The 9–10 o'clock seating positions allow for securing the smallest distance possible between the operator and the patient's mouth, while allowing for a direct visual access into the oral cavity when the patient is reclined into a supine position. Unfortunately, the access opening to the mouth is not located in the horizontal plane for most dental procedures. Instead, the opening of the mouth has a downward inclination towards the chin. With that in mind, the operator must now rotate the microscope laterally along the sagital axis, which causes the eyepieces to be on an inclined plane. This in turn forces the operator to assume an inclined neck position toward the right shoulder to accommodate the placement of the eyes on the eyepieces of the microscope. Working with an inclined neck posture is usually coupled with the over extension of the left arm (assuming a right handed operator) to facilitate the holding of the mouth mirror for use, either as a mirror, or as a retractor. This combination of muscle tension leads to fatigue, pain and musculoskeletal disorders, and possibly disability. For the microscope user to be comfortable when using the microscope, it requires a posture where muscle tension is minimized and equalized between the left and the right sides of the body and the arms. The ideal microscope position that can be conducive to assuming such posture must allow the operator to be seated in the 12 o'clock position and allow for adequate extension of the microscope between the objective lens and the eyepieces that is at least equal to the distance between the top of the head of the patient to the patient's mouth, to prevent the operator from bending forward to reach the eyepieces and cause strain on the lower back.
The MORA interface was developed in response to the challenges listed above.

Definition:
The "MORA Interface" is a Mechanical Optical Rotating Assembly that connects at a right angle the binocular tube to the body of the operating microscope to make it capable of a limited independent rotation around the horizontal axis of the binocular tube.

Description:
The suspension system is directly attached to the MORA Interface instead of attaching directly to the body of the microscope. The body of the microscope is then attached vertically to the port of the Interface facing the floor, while the inclinable binocular tube is attached horizontally to the port facing the operator. It is designed to maintain the eyepieces level with the horizon during tilting or panning of the microscope body from side to side, to a maximum of ± 25°.

Microscope Ergonomics:
The use of the microscope does not change the basic ergonomic principles associated with gaining visual and working access familiar to non-microscope operators. In that, gaining visual access as well as working access to the operating field are totally dependent on the limitations imposed by the posture of the operator. While working with the microscope forces the operator to sit upright, as dictated by the selected focal length of the objective lens and the added dimension between the objective lens and the eyepieces, it makes microscope positioning limited by the operator's ability to keep his/her eyes on the eyepieces within an imaginary envelope of postural extensions that can accommodate various microscope positions relative to the operator's eyes.

Postural Problems with Working under Microscope Magnification:
1. Restricted and posture-dependent access: Gaining visual access to the operating field with a microscope is a process totally dependent on the operator's postural limits. The microscope cannot be positioned outside the envelope of postural extension of the back and neck of the operator if the eyes are to remain on the eyepieces. Any movement of the microscope will induce a change in the head & neck and upper & lower back positions. The most practical way to use a microscope has been with the operator sitting in the 10 o'clock position. Sitting in this position forces the operator to tilt the microscope by rotating it clockwise to gain visual access to the patient's oral cavity, and subsequently tilting his/her head toward the right shoulder resulting in an unfavorable and strained postural neck position (the Taco neck position).
2. Muscle tension & pain: Assuming strained postural positions for extended periods of time cannot be avoided when performing clinical dental procedures under microscope magnification. This will result in discomfort, muscle contraction and pain. A strained visual postural position is further compounded by strenuous working positions resulting from the overextension of the arm holding the mouth mirror, and the forces required to stabilize it during use, either as a reflector, or as a retractor. This usually leads to shoulder and neck pain.
3. Assistant's co-observation tube moves: Tilting the microscope from side to side results in a greatly magnified vertical movement (up or down) at the eyepiece level of the co-observation tube. This renders the co-observation system useless or time-consuming to readjust to these fast-changing operating positions. In addition, sitting in the 10 o'clock position will place the assistant in the 1 o'clock position, an unfavorable location for an assistant.

The Solution:
The MORA Interface provides a solution to the problems listed above, by creating a "posture-friendly" microscope system. To obtain the maximum benefits from the MORA Interface, the operator must be seated in the 12 o'clock position. A microscope with a MORA Interface and a beam splitter increases the horizontal distance between the eyepieces and the long axis of the body of the microscope. It provides a horizontal working distance that is compatible with the distance between the top of the head and the mouth of the patient. This distance allows the operator to be seated in the 12 o'clock position, which can make the following possible:
1. Swinging the microscope body in a panning motion to the right and to the left sides of the mouth (25° in each direction), independent of the eyepieces. This way, the horizontal position of the eyepieces, and subsequently the operator's eyes remain unchanged and in constant position.
2. Panning the microscope body with ease due to the massive reduction in the weight of the moving parts when compared to moving the whole microscope. And because the center of rotation is located in the same plane as the planned rotation motion, the effort that goes into producing the rotation movement is intuitive and minimal.
3. Providing the assistant with the ability to sit in the 3 o'clock position and utilize a co-observation tube that can stay level.
4. Allowing the operator to sit in an upright position with an upright neck and eliminating the need to tilt the neck to the side.
5. Allowing the operator to equally extend the right and the left arms around the patient's head and thereby work more comfortably.
Eliminating the necessity to overextend one arm during a long procedure will minimize the muscle tension in the upper back.
6. Proper utilization of arm and wrist supports.
7. Giving the operator the ability to stabilize and control the patient's head movement.

Conclusion:
The MORA Interface can save your neck and upper back and can allow your assistant to use a co-observation tube. It makes working with a microscope more intuitive, more productive, and more enjoyable.

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