There are a great variety of loupes and headlights being sold to clinical professionals. Some are made very well and some very poorly. It is difficult to spot the difference. Unfortunately there are no government standards controlling the quality of loupes and headlights, despite the fact that improperly made products can be very harmful to one’s long term health. Improperly designed or fitted loupes can create serious ergonomic problems such as eye strain, headaches, neck pain/injury and upper back pain/injury. And improperly designed LED headlights may stress and damage your vision. Before purchasing loupes you owe it to yourself to understand the ergonomic issues related to loupes.

Most loupes manufacturers may tell you that their loupes are ergonomically designed. Since this claim is not regulated in any way, it is easy to say. Is this claim valid? The answer may be only partially true for most loupes.

Loupe customizations that can make or break your working ergonomics include working distance (WD), inter-pupillary distance (IPD) and declination angle (DA). Although having a low total weight and comfortable frames are also important ergonomic factors, they are not critical to building truly custom loupes. All major loupes manufacturers have little trouble customizing all the ergonomic fittings excluding (DA) which is the most important ergonomic factor. Small DAs will force users to excessively tilt their heads resulting in stress, quicker muscle fatigue and chronic neck pain (possibly herniated disks) (Figure A). Why is it difficult to achieve truly custom DAs? If we review the evolution of loupes we can understand why.

![Figure A: Larger Declination Angle (DA) reduces Head-tilt Angle (HA)](image-url)
The Evolution of Loupes

Loupes were originally developed to help visually impaired patients read. About 50 years ago, surgeons began using these loupes during operations. About 30 years ago, the practice spread to dentistry.

There are two types of loupes categorized by the way they are mounted:

Traditionally-designed, through-the-lens (TTL) loupes (Figure B): These have a fixed convergence angle (CA) based on IPD & WD and a fixed DA. Two drawbacks of traditional TTL loupes are: (1) the small DA is restricted by frame designs (often too small) and (2) they are heavy.

Traditionally-designed, generic front-lens-mounted (FLM) loupes (Figure C): These have an adjustable (or fixed) CA and adjustable IPD with a generic DA. Three drawbacks of traditionally-designed, generic FLM loupes are: (1) the DA is not customizable, (2) they are heavy, and (3) the mounting mechanism with sliding arms (which is the most popular among three different mounting types) is not stable and easily comes out of alignment. The DA achieved with this type of loupes will vary according to the facial features of the users. Thus, the achievable DA changes depending on the user. Users have no chance to customize the DA for their desired posture.

In the early 1990 SurgiTel introduced the first truly customizable, ergonomic FLM loupes which were designed based on several patented innovations.
These customizable FLM loupes allow users to create their optimum DA for maximum comfort. Several years later SurgiTel introduced ergonomic TTL loupes by developing a new type of frame which allows TTL loupes to achieve better DAs. And recently SurgiTel introduced micro line loupes. This next-generation technology has been made possible by several new patented innovations. These loupes are extremely light and can be used all day without feeling the weight.

**SurgiTel’s ergonomic, custom TTL loupes (Figure D):**
Like traditional TTL loupes these loupes have a fixed CA based on IPD & WD and a fixed DA optimized for the user’s working posture. These loupes have more custom DA options than traditional TTL loupes using patented frames. Since Oakley frames meet our ergonomic requirements and provide excellent eye protection, SurgiTel offers Oakley frames exclusively under an agreement with Oakley. **Figure E** shows SurgiTel micro TTL prism loupes and other prism loupes. SurgiTel micro prism loupes offer larger DA and are significantly lighter than other loupes. Most traditional prism loupes are 70%-200% heavier than SurgiTel micro prism loupes.

**SurgiTel’s truly customizable FLM loupes with flip-up option (Figure F):** Like TTL loupes these loupes have a fixed CA based on IPD & WD and a fixed DA optimized for the user’s working posture. Custom FLM loupes allow users to re-customize the DA if they want to change their working posture. The mounting arms, with exclusive patented stabilization technology, are extremely stable and will precisely maintain optical alignments throughout use.
Differences between Custom TTL Loupes and Custom FLM Loupes

Custom TTL loupes are built for specific users but they are made based on one set of measurements for a specific working posture. And due to limitations of traditional frames the DA of traditional TTL loupes is not truly custom. SurgiTel can offer truly custom DAs with its various frame options. If users know their true working posture TTL loupes may be a good choice. If the DA is not correct, however, this may be the main cause of chronic neck pain.

Like custom TTL loupes custom FLM loupes are for specific users with specific DAs, but users can change the DA if they want to change their working posture. With SurgiTel’s custom FLM loupes users can also change IPD. Note that IPD varies as the WD varies within the depth of field of loupes.

There is an additional consideration. TTL loupes have to be returned to manufacturers to update the eyeglass prescription. But the eyeglass prescription of custom FLM loupes can be changed by your local optical shop.

Misinformation Perpetuates Pain

Many clinicians have switched to ergonomic loupes to alleviate their chronic neck and upper back pain. But, because it is not easy to recognize root causes for chronic pains, improperly designed loupes are still being used today.

- A long standing myth persists that chronic neck and back pain is a necessary evil associated with the practice of dentistry or surgery. This is not the case. Clinicians only need to recognize the importance of ergonomic working posture and take the necessary steps to release themselves from pain.
- Ergonomically flawed loupes force users to tilt their head too far, resulting in poor working posture. Poor posture takes time to inflict chronic neck and upper back pain. This contributes to clinicians’ misdiagnosing their own condition, thinking that their neck pain is due to poor pillows or some other source. Many clinicians do not know that their loupes are a major cause of their neck and upper back pain.
- Loupes which work well for one person may not work so well for another. The best loupe types, magnification levels and other features strongly depend on their user and their work. Many make the mistake of choosing loupes based solely on what their peers or mentors use, without finding out what will work for them personally.

There are many misconceptions about loupes. Sources often include outdated information used in unscrupulous sales tactics.

Misconception #1: Just by using any type of loupes one can prevent neck and back pain.

The Truth: Using ergonomic custom loupes correctly can help prevent neck and back pain. This means the WD and DA are correctly fit for the clinician and their work. The use of improperly designed or fitted loupes, with too small or too large DA, will instead be a major cause of neck and upper back pain.

Misconception #2: TTL loupes are lighter than FLM loupes.

The Truth: This may be true if both the TTL loupes and the FLM loupes are using the same optics and frame. But TTL loupes often need heavier frames than FLM loupes in order to maintain optical alignment. Traditional TTL loupes are significantly heavier than SurgiTel micro line loupes.
Misconception #3: FLM loupes easily come out of alignment.

The Truth: This statement may be true with generic FLM loupes. But with SurgiTel’s custom FLM loupes the patented hinge “locks-down” CA and DA. The mounting arms are designed using several of SurgiTel’s patented concepts which result in extremely stable mounting arms of oculars. Alignments of SurgiTel FLM loupes can be maintained even better than most TTL loupes. If the frames of TTL loupes are twisted or bent they will come out of alignment. TTL loupes need sturdy frames. But alignments of FLM loupes are not affected by any minor distortions of frames.

Misconception #4: TTL loupes mean a larger field-of-view.

The Truth: This statement may true to users who have a high nose and deep eye sockets. This will not be true for users who have average or small noses. TTL loupes instead create large blind spots (often called magnification scotoma) for users with small noses and oculars are often too close to eyes.

Misconception #5: Any magnification provides users with superior visualization.

The Truth: The visual acuity of the unaided human eye is relatively limited. So low power loupes do not provide users with a truly different way to work. SurgiTel Prism Pro line (5.5x, 6.5x, and 8.0x) loupes are designed to provide users with truly superior visualization.

Misconception #6: Magnification powers claimed by all manufacturers are similar.

The Truth: There is no standard to which defines the magnification power of loupes because loupe magnification power changes as working distance changes. Each company measures the magnification power of their loupes differently. For low power (2.5x) loupes, differences among companies may be small. But for high power loupes (more than 3.5x) there may be significant differences among companies. If you are interested in loupes higher than 3.5x, test what you can see with them rather than relying on the presented number.

Recommendations for Clinicians

The quality of your work depends on your vision. The selection of the best loupe for practice is extremely important because loupes affect your vision and long-term health. Loupes can make or break your ergonomic working posture.

First, we recommend that you should buy the best loupe considering both visual and ergonomic factors. Second, if you have started to experience neck and upper back pain we strongly recommend that you make an appointment with one of ergonomic consultants. If you send me a few digital photos of your actual working postures with patients, I can offer a preliminary, remote consultation. Either way, please make sure to act. Make sure your loupes are doing the best for you and your health!

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