Surface ablation techniques versus lasik in corneal refractive surgery : Present and future

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Summary & ConclusionRefractive surgery has become the most rapidly developing field in ophthalmology over the last two decades. Several modern refractive procedures have become available over the last 10 years. No single procedure works best for everyone; each one has its own set of advantages and disadvantages. Careful patient selection is the key for optimum visual outcomes. Treatment algorithms have been refined over the years, improving accuracy. Laser technology and delivery platforms are under continuous improvement, leading to increasingly precise results. Further modifications and refinements are ongoing, offering expanding surgical options in this rapidly evolving field.Surface ablation techniques include photorefractive keratectomy (PRK), laser subepithelial keratectomy (LASEK) and epithelial laser in situ keratomileusis (epi-LASIK). They differ mainly in the manner in which the corneal epithelium is removed prior to laser ablation. Excimer laser is then applied to photoablate the anterior corneal stroma. In PRK, the first available treatment modality from this group, the epithelium is removed either mechanically by scraping it with a blade or chemically by using a diluted solution of ethanol. In the latter approach the epithelial sheet is not repositioned after laser ablation. On the other hand, in LASEK, the flap is repositioned gently over the ablated tissue. An alternative surgical procedure to separate the epithelium mechanically by using an epi-keratome was introduced by Pallikaris et al., in 2003. The technique is widely known as epi-LASIK.In PRK,the application of 18–20% solution of ethanol breaks the hemi-desmosomal attachments, cleaving the basement membrane betweenSummary & Conclusion103lamina lucida and lamina densa, allowing the sheet to be removed or peeled off without disintegrating. Using dilute solution of alcohol to remove the epithelium is easy, fast and safe compared with mechanical debridement, although alcohol can be potentially toxic to the epithelial and stromal cells. In addition, alcohol-assisted PRK can produce sharp wound edges and a smooth Bowman’s zone and thus less haze and corneal irregularities than with mechanical removal.The advantage of epi-LASIK over LASEK is that the epithelium can be peeled off as a complete sheet without the use of alcohol. Several epi-keratomes have been developed for the epithelial dissection, which will allow the creation of epithelial sheet. These devices differ from LASIK microkeratomes in that the blade and its angle of cutting are designed for a clean subepithelial dissection in anterior Bowamn’s zone, without disrupting the stromal tissue.In the early 1990s, Pallikaris

and Buratto independently described a technique of laser ablation of the corneal stroma, which involved the creation of a flap of anterior stroma including Bowman's and epithelium with the aid of a microkeratome. LASIK was the name given by Pallikaris to this globally adopted procedure. The development of laser technology and the improvement of LASIK surgical techniques including tracking systems, refined nomograms, femtosecond flaps and WG treatment, have all taken place in the rapid evolution of LASIK which proudly celebrated its 20th anniversary in 2010.LASIK involves creating a corneal flap, moving it to the side, using the excimer laser to reshape the underlying cornea, and replacing the flap. To create the flap, a suction ring is placed on the eye, the eye is pressurized, and a sharp vibrating blade or femtosecond laser is used toSummary & Conclusion104create the flap, which is about 1/4 of the thickness of the cornea. The flap is created with a hinge so it can be easily repositioned.LASIK has been used to treat up to 12.00D of myopia, 6.00D of hyperopia and 5.00D of astigmatism. However, due to risk of long-term ectasia, the recommendation have been revised down to around 10.00D ensuring that a residual bed of 275µm is maintained allowing for the flap thickness. LASIK is a lamellar laser ablation technique in which a superior or nasal hinged corneal flap is created by mechanical microkeratome or femtosecond laser. The flap is reflected at the hinge away from the stroma prior to laser ablation. The flap is then repositioned. Pre-placed marks on the flap and corresponding peripheral cornea ensure accurate repositioning.Automated mechanical microkeratomes create flaps of 130–180 microns. Femtosecond lasers have been reported to create more accurate, uniform and thinner flaps (100µm or less). Furthermore, they induce less astigmatism, higher-order aberrations and epithelial ingrowth compared with mechanical microkeratomes. However, femtosecond lasers are more expensive and have their own complications, such as increased incidence of diffuse lamellar keratitis (DLK), anterior chamber bubbles and opaque bubble layer.Surface ablation is a better option than LASIK in patients with epithelial irregularities, dry eye syndrome, large pupils, thin corneas, patients with possible risk of post-LASIK flap dislocation and in patients with possible risk of keratectasia.As PRK has been around for longer than any of the other procedures, data from several long-term follow-up studies are available. Myopic-PRK has been reported to be a safe, stable and effective procedure in the long term.Summary & Conclusion105In 2008, Alio et al. reported that 77% of patients with myopia less than 6.00D had UCVA of 20/40 or better 10 years after PRK. This rate DROPped to 63% in patients with myopia more than 6.00D. Minimal haze and good stability were reported in eight- and 12-year follow-up studies. In a meta-analysis study, refraction stabilization was achieved three months after PRK.The most common complications of all surface ablation techniques are pain and corneal haze. Haze is significantly less common and less severe following correction of low myopia compared to high myopia. Mitomycin-C (MMC) is often used during surface ablation procedures to prevent haze by modifying the corneal wound-healing process. A recent meta-analysis showed that MMC led to significantly less corneal haze in PRK. However, no advantage of MMC was found in LASEK and epi-LASIK.LASIK has been reported to be superior to PRK in terms of patient comfort post-operatively, visual stabilisation and rehabilitation, and stromal haze formation. Moreover, LASIK tends to offer higher rates of efficacy and

predictability and a lower rate of regression, especially in high degrees of ametropias.On the other hand, LASIK appears to have its own specific complications. Flap-related complications including free flaps, buttonhole flaps, irregular flaps and post-LASIK traumatic flap displacement are serious complications unique to this technique. Recent improved designs of microkeratomes have led to a decrease in the rate of some of these complications. Epithelial ingrowth, dry eye syndrome and DLK also known as ‘sands of Sahara syndrome’, are specific complications to LASIK.Summary & Conclusion106In a review of US Food and Drug Administration (FDA) approved clinical studies, LASIK has been reported to be effective, predictable and safe technique for treating low to moderate myopia. Ninety-six percent of patients that underwent LASIK achieved UCVA of 20/40 or better and at least 67% were at 20/20 or better. In the same study, 96% were between ±1.00D of intended treatment. Loss of two or more lines of BCVA occurred in less than 1%.