



# Comparisons between Kahook Dualblade (KDB) Goniotomy vs Selective Laser Trabeculoplasty (SLT)

YC Yap\*; Laura Boddy; Siddharth Agrawal

Department of Ophthalmology, Pennine Acute Trust, Northern Alliance Care, UK.

**\*Corresponding Author: YC Yap**

Department of Ophthalmology, Pennine Acute Trust,  
Northern Alliance Care, Rochdale Infirmary, Whitehall  
St, Rochdale OL12 0NB, UK.

Email: eyapyc@gmail.com & eyapyc@doctors.org.uk

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## Background

Various treatments modalities have been advocated to treat patients with glaucoma or OHT. We compare the effectiveness between Kahook Dual Blade (KDB) goniotomy vs Selective Laser Trabeculoplasty (SLT).

**Objectives:** To compare the reduction of IOP between two treatment arms KDB goniotomy vs SLT treatment.

**Design:** A retrospective study on 48 eyes treated with KDB goniotomy or SLT treatment.

**Settings:** Pennine Acute Health Trust.

**Participants:** POAG or OHT patients in one or both eyes who were aged  $\geq 18$  years, able to provide informed consent, visual acuity of at least 6/36 in the study eye with suboptimal IOP control despite on antiglaucoma medications. Patients were excluded if they had congenital, early childhood or secondary glaucoma or ocular comorbidities, if they had any previous ocular surgery except phacoemulsification. Patients in the SLT group should not have previous SLT treatment before.

**Interventions:** KDB goniotomy vs SLT according to lower IOP.

**Main outcome measures:** Effectiveness of IOP lowering at 6-8 weeks after treatment.



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## Results

The KDB goniotomy data was obtained from 24 eyes of 20 patients, 10 were female and 10 procedures were on the left eye. Patients were diagnosed as advanced or end stage glaucoma with disc/cup ratio  $>0.7$  (mean=0.91). Average IOP of the chosen eye prior to surgery was 21.4 mmHg (95% CI 20.87-25.01). Average visual acuity prior to procedure was 6/9. SLT were performed on 24 eyes of 15 patients, 8 were female and 13 procedures on the left eye. There were 11 patients with POAG and 4 patients with OHT. Average visual acuity before the laser was 6/9. The average IOP pre op was 19.7 +/- 1.01 mm Hg with average post treatment IOP of 16.2 +/- 0.61 mm Hg. All patients after the SLT were told to continue with their medications. The mean difference in IOP reduction at the one month mark is statistically insignificant at the 1 month mark. Mean IOP reduction for SLT (Standard Error) = -3.583mmHg (0.722). Mean IOP reduction for KDB (Standard Error) = -4.795mmHg (1.476). Unpaired T-test analysis p-value = 0.4663.

**Limitation:** Retrospective study on a small group of glaucoma patients with follow up of 6-8 weeks.

## Conclusions

Both treatment groups are comparable in their outcomes of lowering IOPs. Treating clinicians would have to choose the type of treatment depending on individual patients.

Glaucoma is a one of the commonest cause of blindness worldwide. Prevalence of glaucoma is estimated to be 2.1% in adults over the age of 40 [1]. The different treatment modalities to Lower Intraocular Pressure (IOP) include medications, laser, stents or surgery. Kahook Dual Blade goniotomy removes the trabecular meshwork decreasing resistance to aqueous outflow causing the lowering of intraocular pressures.

It has been reported that goniotomy with the KDB lowered IOP by 24-36% and medication burden by 37-70% through 6-12 months of follow-up when performed as a standalone procedure or combined with phacoemulsification cataract surgery [2,5].

Selective Laser Trabeculoplasty (SLT) can be performed at the outpatient laser clinics. It results in selective absorption of thermal energy by trabecular pigmented cells, sparing adjacent cells and tissues. It was first introduced in 1995 and for the past few years has been advocated to be offered as first line of treatment [6]. Success rate of SLT to lower IOP has been reported from 6.9-35.9% [7,8]. We compare the two different modalities that were carried out in glaucoma patients and looked at the results from 4-6 weeks.

## Methods

### Study design and participants

This is a retrospective study on 2 groups of patients who underwent KDB goniotomy or SLT during the same period. The group consisted of 24 eyes each recruited between 1st January 2019 to 16st May 2021 in our department. Pre and post procedural Intraocular pressure, visual acuity and medication regimes were recorded pre-procedure and post-procedure at 1 week and 1 month for the goniotomy group and 6 weeks post laser for the SLT group. Data was analysed using R statistical software using paired and unpaired T tests to assess significance [9]. Comparative dot plots were generated using the ggplot2 package [10].

The study was conducted in accordance with good clinical practice guidelines and adhered to the tenets of the Declaration of Helsinki. The study has been approved by the trust Research and Innovation Committee. Ethics approval was not needed as this is a retrospective study.

## Techniques

### KDB goniotomy

The Kahook dual blade goniotomy are performed after phacoemulsification in our department. The KDB is introduced through the temporal incision used for phacoemulsification and IOL. The anterior chamber was protected using Heavy Healon Ophthalmic Viscosurgical Device (OVD) and Miochol injected for visualisation of angles. The patient's head was rotated between 30 and 45 degrees in the opposite direction of the doctor, while the microscope was tilted between 30 and 45 degrees away from the doctor's position. A straight gonioscope is placed on the cornea with the non-dominant hand. The Kahook dual blade was inserted with the dominant hand along the temporal incision. The piercing of the trabecular meshwork was carried out using the dual blade tip with the footplate heel sitting against the Schlemm canal's anterior wall. The pushing of the device through the Schlemm canal was either in a clockwise or a counter-clockwise bearing. The trabecular meshwork strip was adequately removed in one bearing for 3 to 4 clock hours. The dual blade is removed from the eye, followed by the free-floating trabecular meshwork by the irrigation-aspiration hand-piece while the OVD was being removed. The anterior chamber is filled with intracameral Cefuroxime and Kenalog. Topical G Maxidex 0.1% PF is prescribed 10 times a day for 6 weeks and Occ Maxitriol at night.

### SLT

The SLT platform used was a Selecta Duet Laser with 532 nm Q-switched frequency doubled Nd: YAG laser source. The laser platform uses a standardized spot size of 400 microns and pulse width of 3 ns. The patients' eyes were prepared with topical pilocarpine 2% for visualization of angle structures and apraclonidine 1.0% eye drops instilled 20 minutes prior to laser treatment to prevent IOP spikes. Laser was delivered immediately after instillation of topical anesthetic oxybuprocaine 0.4% and application of Latina SLT Gonio Laser Lens with a coupling methylcellulose agent on the lens surface. Our standard treatment consisted of treating 360 degrees of the Trabecular Meshwork (TM) with total laser applications of 100 continuous non-overlapping laser spots (25 per quadrant) delivered during one session. The energy level per shot used in our study eyes ranged from 0.3 to 1.4 mJ which was adjusted at 0.1 mJ increments while titrating to individual target end responses. The end response was gauged by tiny bubbles in at least 50 % shots next to the TM but not to have high power. Topical apraclonidine 1.0% was instilled immediately after the procedure to prevent any IOP spikes post laser. No topical corticosteroids or NSAIDs were prescribed before or after the SLT treatment.

## Results

The KDB goniotomy data was obtained from 24 eyes of 20 patients, 10 were female and 10 procedures were on the left eye. Patients were diagnosed as advanced or end stage glaucoma with disc/cup ratio  $>0.7$  (mean=0.91). Average IOP of the chosen eye prior to surgery was 21.4 mmHg (95% CI 20.87-25.01). Average visual acuity prior to procedure was 6/9.68. Post-operative complications included anterior uveitis (n=5), blepharitis

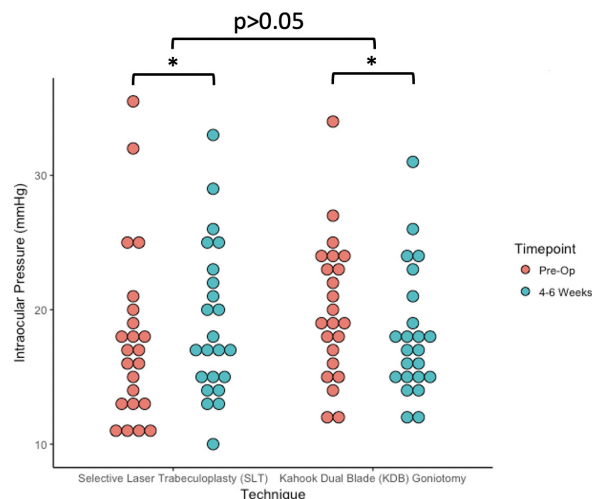
(n=1), drug reactions (n=1) and cornea oedema (n=1). These complications resolved after 6 weeks of surgery.

On average, reduction in IOP at 1 week follow up was insignificant ( $p=0.18$ ) but was significant at one month follow up ( $p<0.01$ ). Differences in visual acuity were insignificant at 1 week and 1 month follow up ( $p>0.1$ ). IOP medication was significantly reduced at 1 week ( $p=0.038$ ) but not at 1 month ( $p=0.176$ ).

SLT were performed on 24 eyes of 15 patients, 8 were female and 13 procedures on the left eye. There were 11 patients with POAG and 4 patients with OHT. Average visual acuity before the laser was 6/9. The average IOP pre op was  $19.7 \pm 1.01$  mm Hg with average post treatment IOP of  $16.2 \pm 0.61$  mm Hg. All patients after the SLT were told to continue with their medications. No differences in visual acuity were detected at 6 weeks follow up.

When we compared the results between the 2 treatment groups, the Mean IOP reduction for SLT =  $-3.58$  mm Hg ( $SE=0.722$ ). Mean IOP reduction for KDB goniotomy =  $-4.795$  mm Hg ( $SE=1.476$ ). Unpaired T-test analysis  $p$  value =  $0.4663$ . The mean difference in IOP reduction between the 2 treatment at 1 month is statistically insignificant.

Intraocular Pressure Before Procedure and at 4-6 Weeks Follow Up



**Figure 1:** Dot plots demonstrating the Intraocular pressure pre-procedure and at 4-6 weeks follow up (\* =  $P<0.05$ , paired T-test).

## Discussion

The goal of the study is to demonstrate the effectiveness and safety of the KDB goniotomy procedure and SLT procedure in lowering the intraocular pressures. Quite a number of the patients who were treated had moderate to end-stage glaucoma. The two procedures offered an alternative treatment option for glaucoma patients as one can be done after routine phacoemulsification without the time consuming and more invasive trabeculectomy and SLT can be done in the outpatient setting. The KDB goniotomy has been found to be more effective when compared to iStent when performed during phacoemulsification and it was found that at month 12, IOP reductions  $\geq 20\%$  were achieved by 64.2% and 41.6% ( $p < 0.001$ ) in the phaco-KDB and phaco-iStent group respectively [11]. SLT was compared with topical anti-glaucoma eye drops as first line therapy to treat ocular hypertension and glaucoma in the LIGHT study and it was found that the SLT treated patients have IOPs within target at more follow up visits (93% vs 91.3%), needing no glaucoma surgery vs 11 in the eye drops group and found to be more cost effective [6].

There is initial efficacy in the IOP lowering effect of KDB goniotomy with phacoemulsification at one month follow up. The initial insignificance of IOP reduction at one week follow up may be due to a premature reduction of glaucoma medications but that at a later follow up once established on glaucoma medication is re-established. Insignificance in IOP reduction at one week may also be accounted for by premature stopping of glaucoma eye drops as well as hyphaema, intra-operative use of Kenalog or inflammation. We have changed our policy informed patients who have end stage glaucoma not to stop glaucoma eye drops after surgery. Post-operative anterior uveitis which is seen to a degree in all patients but can persist for weeks after. This is due to stripping of trabecular meshwork which caused severe anterior uveitis. All these cases resolved after 6 weeks of intense topical steroid drops. The vision did not improve in significant proportion of cases because the vision was poor due to end stage glaucoma and cataract surgery could not improve it.

From our study results, both treatment regimes lowered the intraocular pressures of glaucoma patients. We looked at the short term follow up of this group of patients and only time will tell the on the outcomes in 6 months and 1 year which we eagerly plan to study.

The t-test is a powerful method for pairwise comparison in small samples, having a sample bigger than 10 in KDB alone would have increased the magnitude of the effect and hence the external validity of the results. There was a limitation of follow-up for these patients as during the pandemic period quite a number of patients were loss to follow up. The IOP may come down further after 3-6 months of KDB goniotomy as the effect of the steroids drops washes off. Our study will remain to be monitored for the assessment of decreased in IOP and complications from the treatments.

## Conclusion

Both KDB goniotomy and SLT are effective and safe to reduce IOP and the number of medications in patients with severe glaucoma. The profile of the procedures safety are outstanding and comparable with other glaucoma procedures. The complication rates of both procedures are low and most of them were reversible in a few days. Clinicians would have to decide which treatment is suited for the patients concern as glaucoma patients with cataracts may be more suited for the KDB goniotomy while newly diagnosed POAG patients and patients who is not keen on surgery may opt for the SLT treatment.

The authors have no competing financial interests in relation to this manuscript.

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