

C. BLEPHAROPLASTY STUDY

The surgical procedure of blepharoplasty may be performed under general or local anaesthesia and involves removal of excess skin and fat from the upper and/or lower eyelids. The low tension in the skin of the peri-orbital region means that post-Operative oedema and bruising are inevitable. It is an ideal clinical model for double-blind evaluation of pulsed RF treatment because it provides asymptomatic patients who each undergo a bilateral procedure performed by a single surgeon; the patient acts as his, or her own control. A double-blind pilot study and a recently completed study are described.

C.1 Pilot Study: (Nicolle and Bentall, 1982)

a) Aim

The purpose of this study was to determine the effects of pulsed RF energy on the post operative course of oedema and bruising following blepharoplasty surgery.

b) Method

The pilot study involved 21 patients who had surgery performed under local or general anaesthesia. Active and placebo antennae were manipulated to form a spectacle shape that was held in place on top of wound dressings. The spectacles were applied immediately post operatively and removed after 24 hours. Photographic colour transparencies were taken of the patient on the first day (when the dressings were removed), and on the third day (when the sutures were removed), and at six days at the follow-up visit. Assessment of these slides was made by an independent clinician.

c) Device Specifications

Power Source. 3.5 Volt battery
Carrier Frequency. : 27 MHz
Pulse Width. : 100 microsecs
Pulse Repetition Frequency 1 KHz

d) Results

The independent clinician assessed the slides and determined which of the peri-orbital regions showed clinical evidence of an improvement - a reduction in oedema, bruising and scleral haemorrhage. Two patients were excluded due to technical difficulties with the devices. Of the remaining 19 patients, 11 had visible reduction of the post-operative signs on the actively treated side, this improvement was still discernible at the sixth day follow-up visit. In six patients, oedema and bruising was so slight that no difference was visible. Two patients appeared to have a reduction in the severity of signs on the placebo treated side.

C.2 1984/5 Study (Bentall, Bentall and Nicolle, 1985)

a) Aim

In the pilot study no attempt was made to obtain any numerical estimates of oedema and bruising on which to perform an analysis. The purpose of the present study is to attempt to replicate the clinical effect observed in the pilot study and to quantify that effect using a larger sample of patients.

b) Method

The subjects of this clinical study were the patients of a plastic surgeon (Mr F V Nicolle) practising in London, England. All patients attending for bilateral blepharoplasty who gave their informed consent to participation were entered into the study; there were no specific exclusion criteria. Patients receiving surgery to the upper lids and/or the lower lids were included.

Patients were randomly assigned a pair of lensless spectacles to provide treatment to the lids of one eye but not the other. Active and placebo antennae were fitted into the lightweight spectacle frames and electrical components were housed in one leg of the frames. The placebo antenna was electrically shielded to prevent re-radiation from the active antenna which emitted pulsed RF. energy of the following specifications:

Nominal Power Output : 73 microW
Carrier Frequency. : 26 MHz
Pulse Width. : 73 microsecs Pulse Repetition
Frequency : 900 Hz

Patients therefore acted as their own control and they were not aware which eye received treatment. Treatment commenced immediately following surgery and the patients were instructed to wear the spectacles for 16 hours per day for the following three days. Apart from this no modifications were made to the normal post-operative care of the patients. Patients were asked to keep a log, on a small card provided, of the hours for which they wore the spectacles.

At each post-operative visit, that is at one day (a few cases only) and at three, four or five days after surgery, the nurse took a clinical photograph which was developed into a colour slide. The clinical logistics of the study precluded the taking of absolutely standard photographs. Therefore, in order to be able to make a correction to the measurements for the absolute size of each photograph, it was decided to place a centimetre scale reference sticker on the forehead of each patient prior to the clinical photograph being taken. Unfortunately this decision was not taken until after the first twelve patients had been entered into the study.

c) Measurements

The slides were used to obtain measurements of bruising and the amount each eye was open and they were also clinically assessed by a panel of three judges (one surgeon, one nurse and one lay person).

The bruising beneath each eye was recorded by projecting the slide onto a piece of acetate film and then drawing a planimetric trace of the bruised regions below the median palpebral fissure on each side. Only the areas of clearly defined red or purple bruising were included, not the rather diffuse areas of yellow. A System III Image Analysis Machine (AMS Limited) was then used to measure the area (in square centimetres) of the planimetric trace beneath each eye.

The slides were then projected onto a white piece of paper on which two thin black “+” signs had been drawn. The height of the palpebral fissure of each eye (at the point of bisection of the pupil - see Figure 1) and the size of the centimetre scale reference sticker (when present) were marked off on the “+” to signs with a thin pencil. The paper was then laid flat to enable the amount each eye was open and the length of the scale reference sticker to be measured with a ruler.

To obtain ratings of the extent of oedema, bruising and scleral haemorrhage the three assessors examined the projected slides and recorded a rating of each clinical sign on a specially prepared form. The eyes were rated on the following scale for each sign:

2.R .. The patient's RIGHT eye shows "significantly less" _____ than the patient's LEFT eye.

1. R - The patient's RIGHT eye shows less _____ than the patient's LEFT eye but this is of "little clinical significance."

0 - There is no discernable difference between the patient's LEFT and RIGHT eyes with respect to _____.

1L - The patient's LEFT eye shows.....etc cf 1R above

2L - The patient's LEFT eye shows.....etc cf 2R above

All of the Day 3 (4 or 5) photographs were assessed before any of the Day 1 photographs and the three assessors were blind as to the side of treatment of each patient.

d) Analyses

Bruising and eye-opening data were analysed using related samples t-Tests and contingency tables were drawn up of the clinical assessment data and submitted to Chisquare tests of association.

Patients who failed to return the log of the times the spectacles had been worn or who wore the spectacles for fewer than eight hours per day for at least two days were excluded from the analysis.

Because not all of the pictures were taken with the patients wearing a scale reference sticker it was not possible to provide a correction factor to the measurement data in every case. Two analyses were therefore performed. To include all patients, the data was transformed to the percentage of total bruising or eye opening (see Figure 1) which was on the active side. The second analysis, which used the measured size of the scale reference sticker to convert the bruising data to actual areas, is considered to give a more meaningful picture even though it included fewer patients.

3) Results

PATIENT ENTRY

There were a total of sixty patients available for analysis in the present study. Two of these patients failed to return the log of the times when the spectacles were worn, two had worn the spectacles for fewer than the required 2 days and fourteen had worn the spectacles for fewer than the required 8 hours per day. There were thus forty-two patients entered into the analyses, of whom nine patients had slides from Day One Post-operation and of these two had slides from Day One only.

BRUISING

Figure 2 shows the area of bruising on the actively treated side as a percentage of the total bruising of both sides. It can be seen that for the patients as a whole the percentage of the total bruising which was on the active side was significantly less than 50/0, which is the outcome which would be expected to occur by chance ($t = 2.56$, $p = 0.015$). This is equivalent to a mean reduction in bruising on the active side of 20.7% (95 % confidence interval 5.2 % to 33.8%).

For the 28 patients who had worn the scale reference sticker it was possible to convert the bruised area measurements to actual areas. Figure 3 shows these results. It can be seen that the mean area of bruising on the placebo side was 2.88 sq cms and for the active side it was 2.38 sq cms. This difference was again statistically significant ($t = 2.47$, $P = 0.02$) and indicates that there was 17.4 % less bruising on the actively treated than the placebo side (95 % confidence interval 3.7% to 31 %).

EYE OPENING

Figures 4 and 5 show, for the Day 1 and Day 3, 4 or 5 photographs respectively, the height of the palpebral fissure of the actively treated side as a percentage of the combined heights of the palpebral fissures of both sides. In neither case is this value significantly different from 50% (Day 1: $t = -0.52$, NS; Day 3, 4 or 5: $t = 0.62$, NS).

CLINICAL ASSESSMENTS

Although the clinical sign of oedema is more striking on the first day following surgery too few patients with Day 1 photographs were available to permit a meaningful analysis of the clinical assessments of them. Even for the Day 3, 4 or 5 photographs there were not sufficient patients to perform a reliable analysis of the full five assessment levels. However, by combining the two levels of assessment on each side (2R and 1R, and, 2L and 1L) and excluding the small number of cases assessed as showing no difference (see Table I), the cell entries are large enough to permit meaningful conclusions. It can be seen that there is a strong association between the clinical assessments made and the side of activity of the spectacles that the patient being assessed was wearing (Pearson Chisquare = 6.4, $p = 0.01$).

TABLE 1. Clinical Assessment of Oedema by Surgeon Assessor (Table combining assessment levels).

	Less Oedema on Left	Less Oedema on Right	Total
LEFT SIDE	12	5	17
ACTIVE			
RIGHT SIDE	5	13	18
ACTIVE			
TOTAL	17	18	35

Table 2 (see over) similarly shows the same surgeon's assessments of the patients' bruising. Again the association between assessments made and side of activity of the spectacles worn is statistically significant (Pearson Chisquare = 5.9, p = 0.015).

FIGURE 1. Only six patients show any scleral haemorrhage and there is no evidence of its presence being associated with the side of activity of the spectacles being worn (Pearson Chisquare = 1.3, NS).

TABLE 2. Clinical Assessment of Bruising by Surgeon Assessor (Table combining assessment levels).

	Active	Placebo	
LEFT SIDE			
ACTIVE			
RIGHT SIDE	6	12	18
ACTIVE			
TOTAL	18	16	34

Graphs plot: $\frac{A \times 100}{A+B}$

The results of the other two assessors were in broad agreement with the findings of the surgeon though, with more assessments being "no discernable difference," the same levels of significance were not attained.

f) Discussion

The results of the present study provide objective evidence for and statistical underpinning of the clinical impressions reported in the pilot study. After approximately three days of postoperative treatment with low-levels of pulsed RF energy there is a clear reduction in the area of bruising and in the observable signs of oedema around the treated eye in comparison with the untreated eye.

Oedema occurs during the inflammatory reaction phase of wound healing, though its influence extends beyond this phase and may result in lower wound tensile strength (Speer, 1979) and delay in the onset of the collagen synthesis phase of wound healing (Peacock and Van Winkle, 1976). It is produced by changes in microvascular permeability, by the breakdown of extravasated proteins (which increases tissue osmotic pressure), by increased capillary ground substance (preventing the rise in tissue tension which opposes further release of exudate) (Walter and Israel, 1972). One possible mechanism of action of the pulsed RF fields might be to prevent the disaggregation of the mucopolysaccharides of ground substance which causes its increased fluidity and is one of the earliest features of the inflammatory response. In this way the fluid exudate (oedema) and free red blood cells from the damaged capillaries (bruising) would be less able to spread from the initial site of injury.

It is interesting in this context to note that attempts to model the effects of electric fields on connective tissue (Grodzinsky, 1983) have concentrated on the polysaccharides (GAGs) which are the main charge bearing constituents.

FIGURE 2. Percentage Area of Bruising

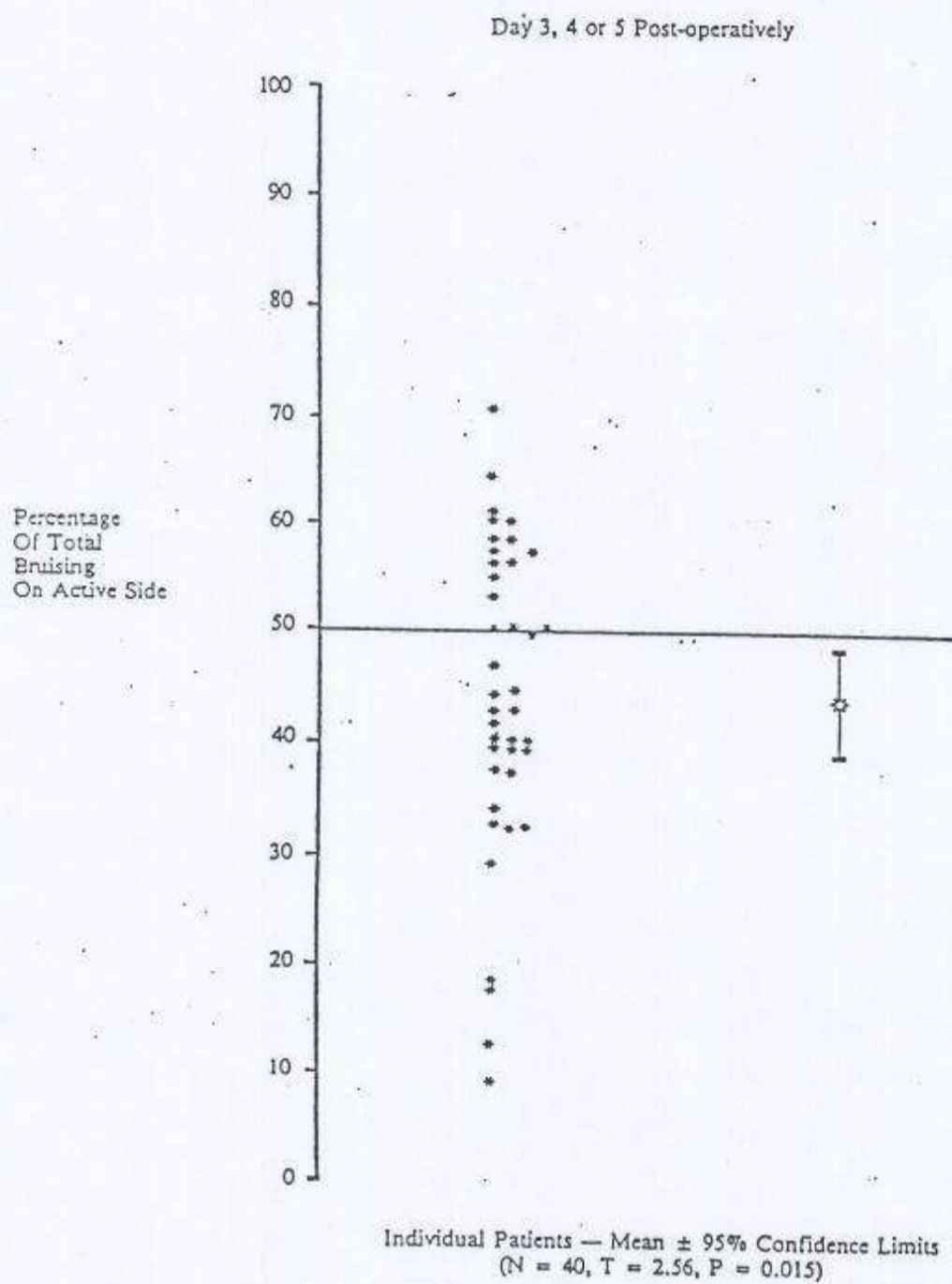
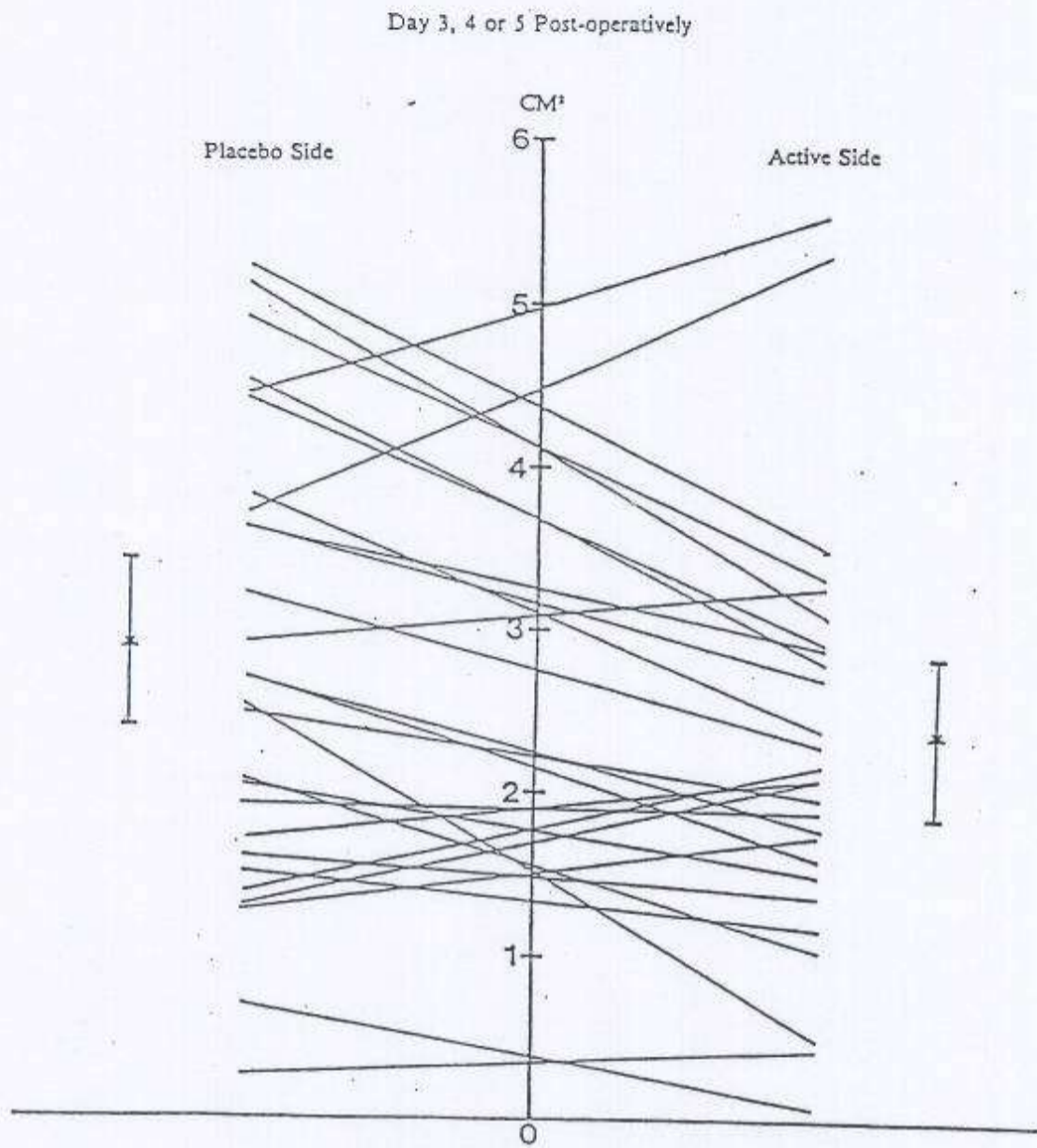


FIGURE 3. Actual Areas Of Bruising in CM²

(N = 28, Mean Difference = 0.50, T = 2.47, P = 0.02)

FIGURE 4. Heights Of The Palpebral Fissure On The Active Side As A Percentage Of The Combined Height Of The Fissure Of Both Eyes
Day 1 Post-operatively

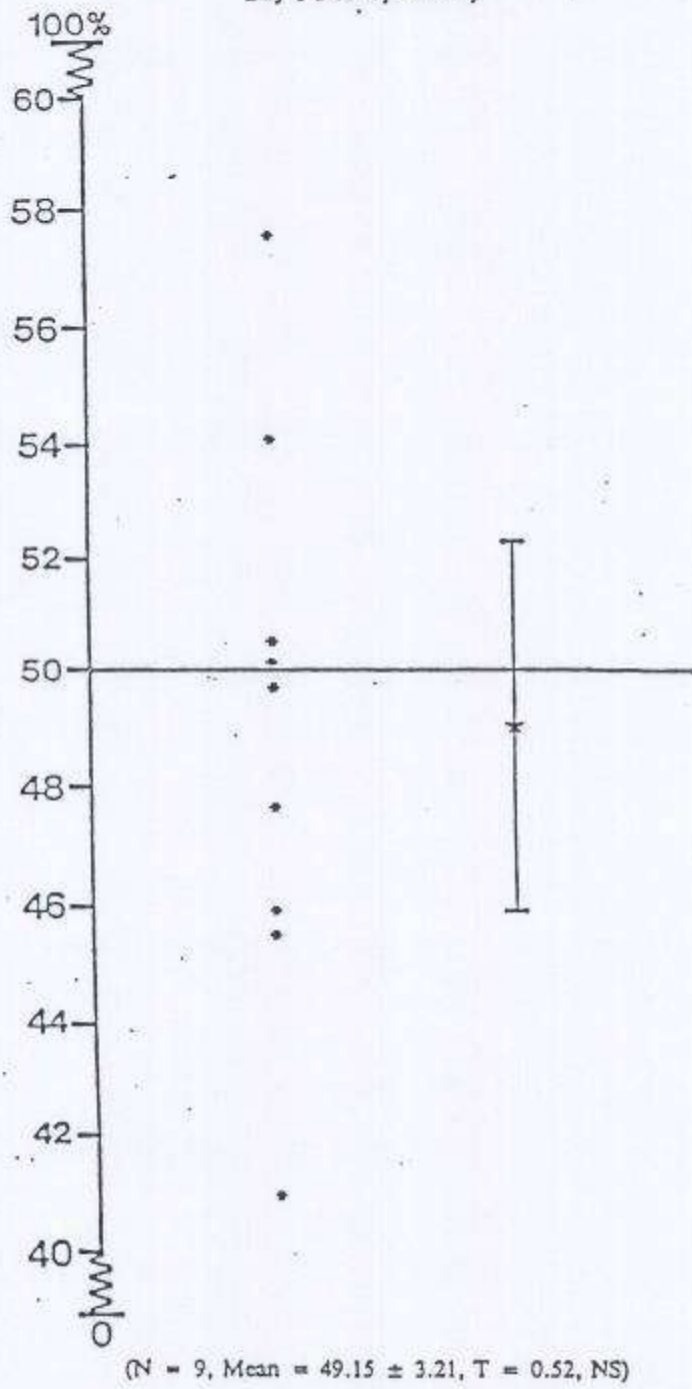


FIGURE 5. Height Of The Palpebral Fissure On The Active Side As A Percentage Of The Combined Height Of The Fissure Of Both Eyes

