Making the Equipment Last Longer and Function Better - *need for in-house maintenance*

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Health care in the present day, especially eye care, is very much dependent on instruments. Most of quality instruments needed are imported from developed countries. The range of instruments used in a medium sized secondary care eye hospital performing about 2000 surgeries a year is given in (Table 1). The cost of the instruments range from a few hundred rupees to a few hundred thousand rupees. It is very important that all the instruments are kept in good working conditions at all times and "down time" during which any instrument is not working is kept to a minimum.

The maintenance task includes taking care of the instruments, providing preventive maintenance and carrying out elementary repairs when necessary. This generally implies:

1. Understanding how the instruments work
2. Knowing the do's and don'ts for each instrument
3. Replacing fused bulbs
4. Replacing blown out fuses after ascertaining the reason for blow off
5. Checking electrical connections when required and also periodically and rectifying defects noticed
6. Checking and lubricating periodically all moving parts of instruments
7. Keeping the instruments clean especially the optical elements
8. Sharpening and repairing surgical instruments
9. Providing the right kind of environment for optimum performance

Who can do all these?

A full time bio-medical engineer can probably do the job. Do we have such people available readily to start work in medium size hospitals? The answer is 'No'. What is the solution? In-house training of technicians is the solution we offer. Polytechnic diploma holders in electrical, electronics and /or instrumentation engineering are available in any city in India. It is probably true in other developing countries as well. They are the most suitable candidates for such training. They have good experience in using hand tools. They understand geometrical and machine drawings. They have sufficient knowledge of electricity and electrical measuring instruments. Those with electronics as one of their options have a good knowledge of electronic components and circuits. They can trouble shoot and rectify faults in electrical and electronic circuits. Their deficiency will be in understanding optics handling optical instruments and some training will bridge the gap. There will be enough work for one person in a medium size hospital we have chosen this for our discussion in this paper

What are the other requirements?

In terms of space a small size room 10' x 10' with a work desk and power point is sufficient for running an instrument maintenance facility in such a hospital. Where a room is not available a separate work desk with power point and safety lockers in the corner of a room in the hospital may be sufficient. A list of tools needed for carrying out the jobs mentioned earlier is given in (Table 2). Consumables needed for running the facility is given in (Table 3). A suggested weekly work schedule is given in (Table 4.)

A six-week training course in instrument maintenance is offered in Lions Aravind Institute of Community Ophthalmology (LAICO), Aravind Eye Hospital, Madurai. We are aware of similar training in other centres. We have run 23 courses training 131 technicians of them 31 are from 12 developing

countries. We have received good reports from the hospitals about several of them. Five of the trainees from West African countries trained at LAICO are now the instructors for the courses being run in West Africa. One of them has established an instrument maintenance facility in his hometown and is providing service to several hospitals in that part of his country.

Some of the spares of the instruments could be fabricated with locally available substitutes without compromising on quality. Our technicians are able to understand the correct role of the spares and fabricate spares there by saving lot of time and money in getting spares.

Table 1. Instruments list

O.P. section	Refraction department	Lab instruments	Theatre instruments
1. Torch light	1. Field tester chart	1. Cell counter	1. Bipolar coagulator
2. B.P. apparatus	2. Field test perimeter	2. Glucometer	2. Operating light
3. Stethoscope	3. Streak retinoscope	3. Table microscope	3. Operating microscope
4. Direct ophthalmoscope	4. Trial drum	4. Photometer	4. Steam sterliser
5. Indirect ophthalmoscope	5. Trial frame		5. Pulse oximeter
6. Lens, 90D, 20D, Gonio	6. E - chart		6. Laryngoscope
7. Slit lamp	7. Trial set		7. Suction apparatus
8. Schotz tonometer	8. Prism bar		8. Phaco machine
9. Applanation tonometer	9. Keratometer		9. Cryo system
10. X-ray viewing Box	10. Lensometer		10. Vitrectomy machine
11. Weighing machine	11. A-scan		11. Emergency light
	12. Hess chart screen		12. Laser machine(YAG)
	13. RAF ruler		13. Surgical instrument
	14. Occulder		

Table 2. Tools list

S. No	Tools name	S. No	Tools name
1.	Line tester	12.	Flat file (smooth)
2.	Digital multimeter	13.	Flat file (rough)
3.	Screwdriver blade 3" long	14.	Round file
4.	Screwdriver blade 6" long	15.	Needle file set
5.	Screwdriver (Philips medium)	16.	Nose pliers
6.	Screwdriver (Philips big)	17.	Cutting pliers
7.	Watchmaker's screw driver set	18.	Ballpin hammer
8.	Watchmaker's philip driver set	19.	Nylon hammer
9.	Allan key set	20.	Hack saw
10.	Spanner set	21.	Baby vice
11.	Wire stripper	22.	Hand drilling machine
		23.	Drill bits

Table 3. Consumables using in instrument maintenance

S. No	Consumables name	S. No	Consumables name	S. No	Consumables name
1.	Soldering lead	16.	Soap powder	31.	Cellaphone tape
2.	Soldering fulx	17.	Wire pocket	32.	Tefflone tape
3.	Copper wik	18.	Sleeves	33.	Switches
4.	Insulation tape	19.	Transformers	34.	Banana pins
5.	Knife	20.	Electronic cells	35.	2 mm socket
6.	3 pin tops	21.	Bulbs	36.	B.P. bag
7.	2 pin tops	22.	Colin	37.	B.P. bulb
8.	3 core wire	23.	Cotton roll	38.	Cryo washers
9.	2 core wire	24.	Baniyan cloth	39.	Tooth brush
10.	Quick fix	25.	Zorrik	40.	Syringe
11.	Fevi kwik	26.	Grease	41.	Candle
12.	Bono fix	27.	Lubricating oil	42.	Match box
13.	Screws and nuts	28.	Araldite	43.	Dettol soap
14.	M-seal	29.	Packing tape	44.	3 pin socket
15.	Emery sheet	30.	Fevicol	45.	Fuse

Table 4. Weekly work schedule

S. No	Name of the instruments	Procedure
1.	Operating microscope	(i) Clean the optics of the microscope using colin and if stain exceeds use Acetone (only for glass lens) (ii) Lubricate the mechanical parts using oil, grease and zorrik (iii) Check the power connections, fuses and bulbs
2.	Slit lamp	(i) Clean the optics of the slit lamp using colin and if stain exceeds use acetone (only for glass lens) (ii) Lubricate the mechanical parts using oil, grease and zorrik (iii) Check the slit arrangement of the slit lamp (iv) Check the power connections and fuses
3.	Keratometer	(i) Clean the outside optics of the keratometer using mild soap solution (ii) Lubricate all knobs of the keratometer using oil and grease (iii) Calibrate the horizontal and vertical reading using lenscometer
4.	Autorefractometer	(i) Check the reading using model eye. (ii) Clean the 4 LED s in the front using colin (iii) Check the power connections and fuses. (iv) Lubricate all the mechanical parts.