

Maintaining a dental chair

- Principles of operation
 - function
 - use
 - scientific principles
- construction
 - components
 - system diagram
 - inputs/outputs
- troubleshooting
 - identifying common faults
 - replacing components
 - rectifying faults
- safety considerations
 - user and patient safety
 - electrical safety



13.5.2 Maintaining a dental chair

Unit B 13.5 Maintaining dental and dental laboratory equipment

Module 279 18 B Medical Instrumentation I

Dental chair: Function / Use

Dental chairs are used by dentists, dental hygienists and dental technicians to support and position their patients during examination, treatment or cleaning of their patient teeth.



Dental chair: Scientific (hydraulic) principles

Pascal's Principle

the pressure in a closed container is the same at all points

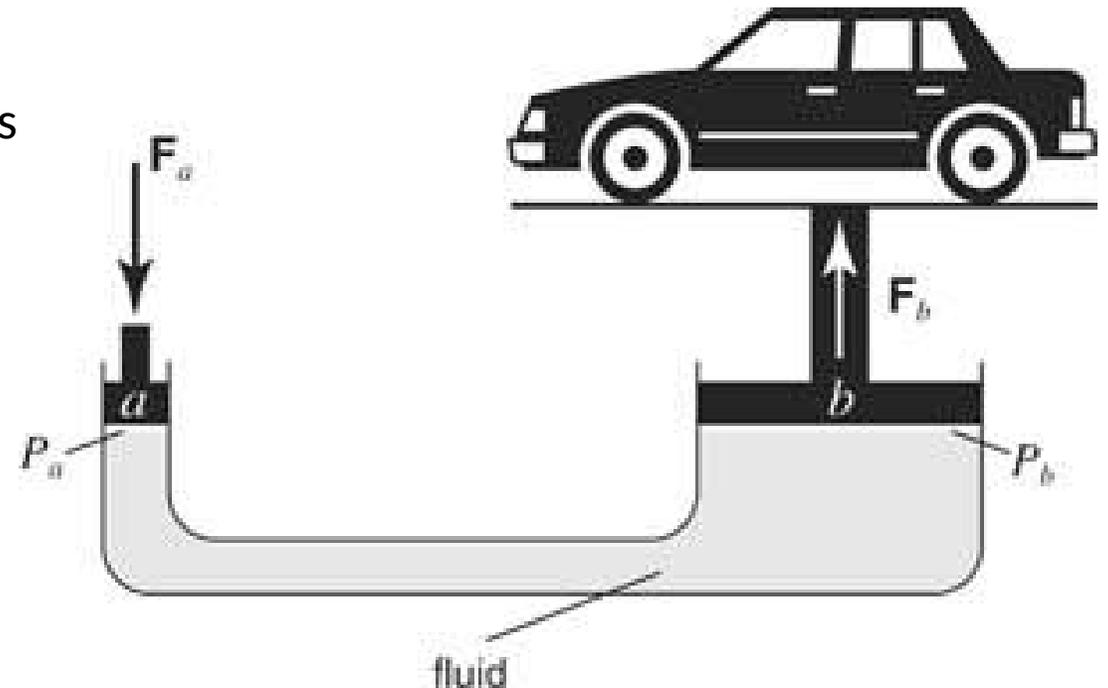
$$P_a = P_b$$

Pressure = Force / Surface
area

Force F_a / Surface a = Force F_b / Surface
 b

Therefore, a small F_a on a small surface a will
generate a large force F_b on a large area b

Of course: the displacement of the car will be much
smaller than the displacement of cylinder a

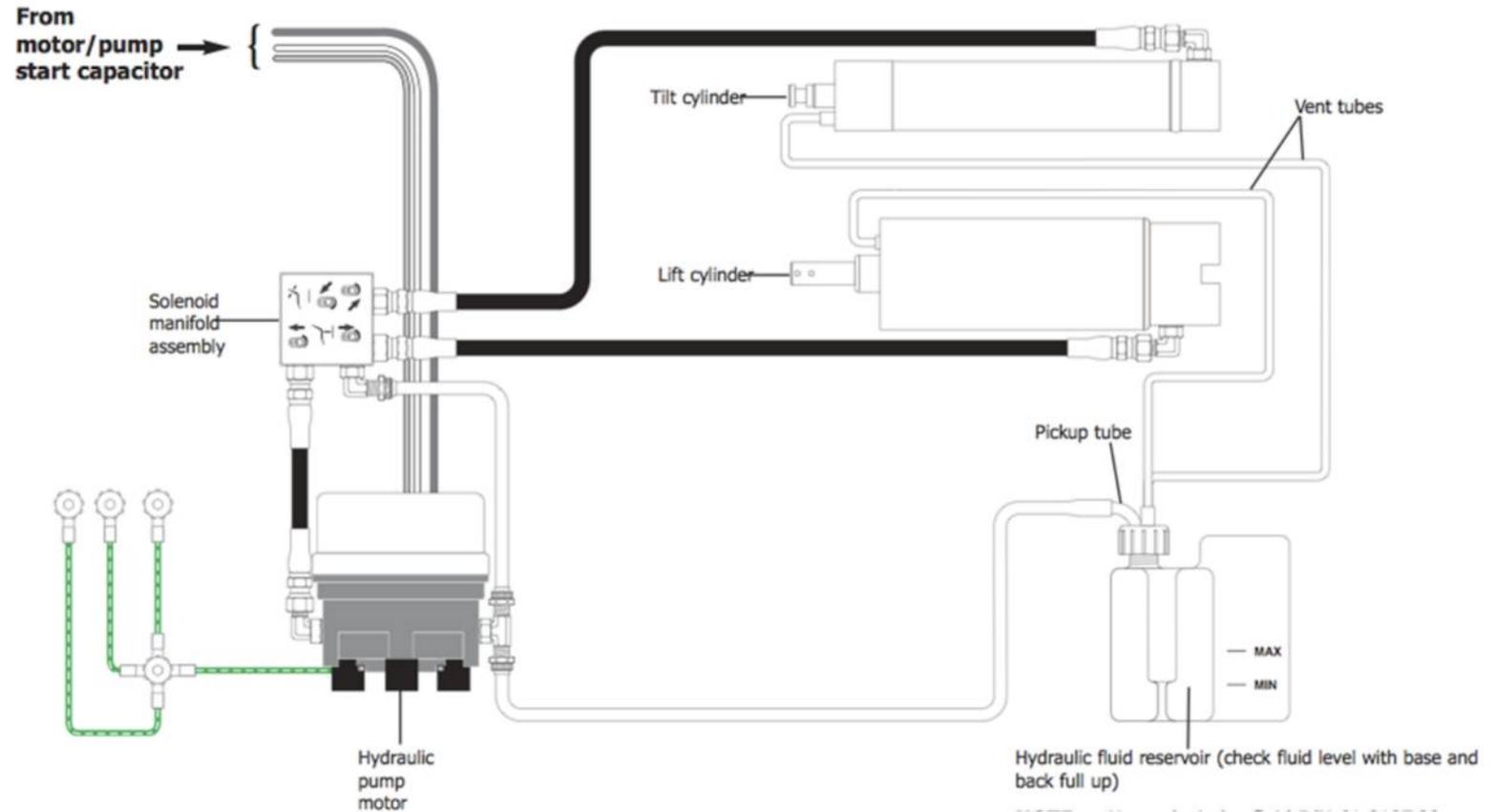


Suppose:
 $b = 10 \times a$, then
 $F_b = 10 \times F_a$ and
displacement of $b = 1/10 \times$ displacement in a .
(you will be 10 times stronger, 10 times
slower)

Dental chair: Construction

Most dental chairs consist of a lower pedestal base and an upper chair assembly.

The pedestal base contains the electric motor and control box. The motor drives a hydraulic pump which drives the hydraulic pistons to position the chair. Control of different movements is organized via a solenoid-controlled manifold.



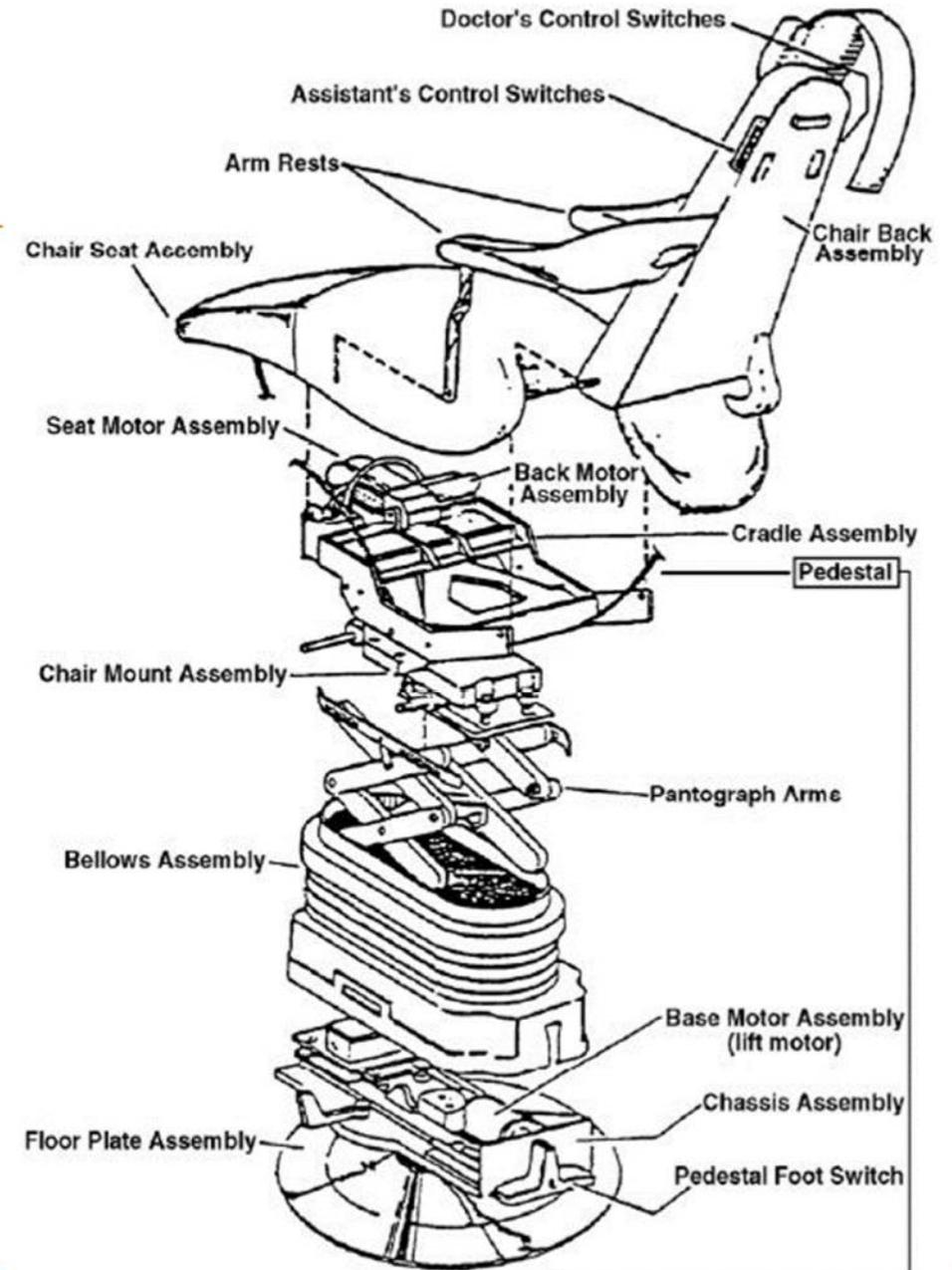
The upper chair assembly rests on the vertical (height) hydraulic piston and is normally connected to the pedestal base with hydraulic pistons to the backrest and footrest.

Dental chair: Construction

Example: electrically operated chair (no hydraulics)

Components

- (1) Floor plate assembly
- (2) Chassis assembly (base motor assembly, foot switch, brake pedal)
- (3) Bellows assembly
- (4) Pantograph arms
- (5) Chair mount assembly
- (6) Cradle assembly (chair back motor, chair seat motor, the AUTO/MANUAL mode toggle switch in junction box)
- (7) Chair seat assembly
- (8) Chair back assembly (control buttons)
- (9) Arm rests

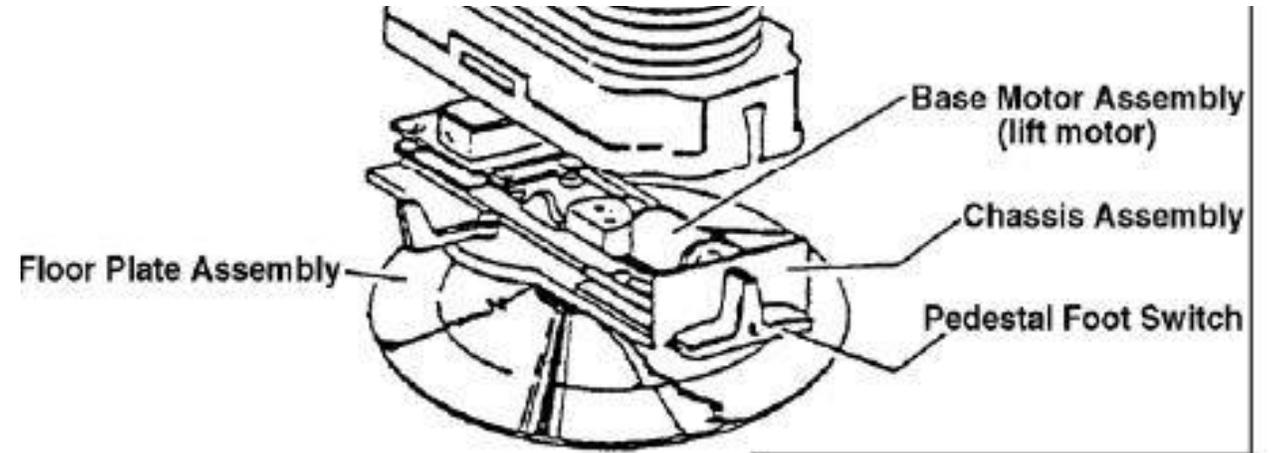


Dental chair: Construction: Pedestal

Pedestal and Base Motor Assembly

the base motor is located on the rear of pedestal in the chassis assembly.

the pedestal can be rotated 360 degrees by releasing the manually operated lock that is located on the doctor's side of the chair at the base of the pedestal.



The purpose of the base (lift) motor assembly is to raise and lower the chair. This is done by using:

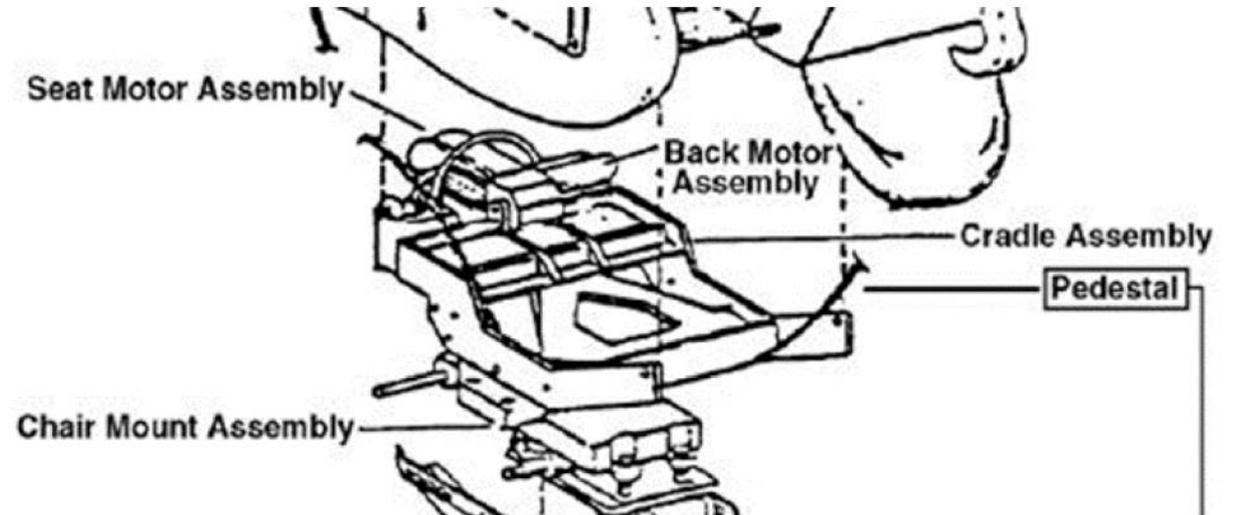
- (1) the foot switch on the pedestal or
- (2) the doctor's lower-most switch

Which lowers the chair to the exit position. You cannot raise the chair with this switch.

Dental chair: Construction: Motor assemblies

Seat Motor Assembly

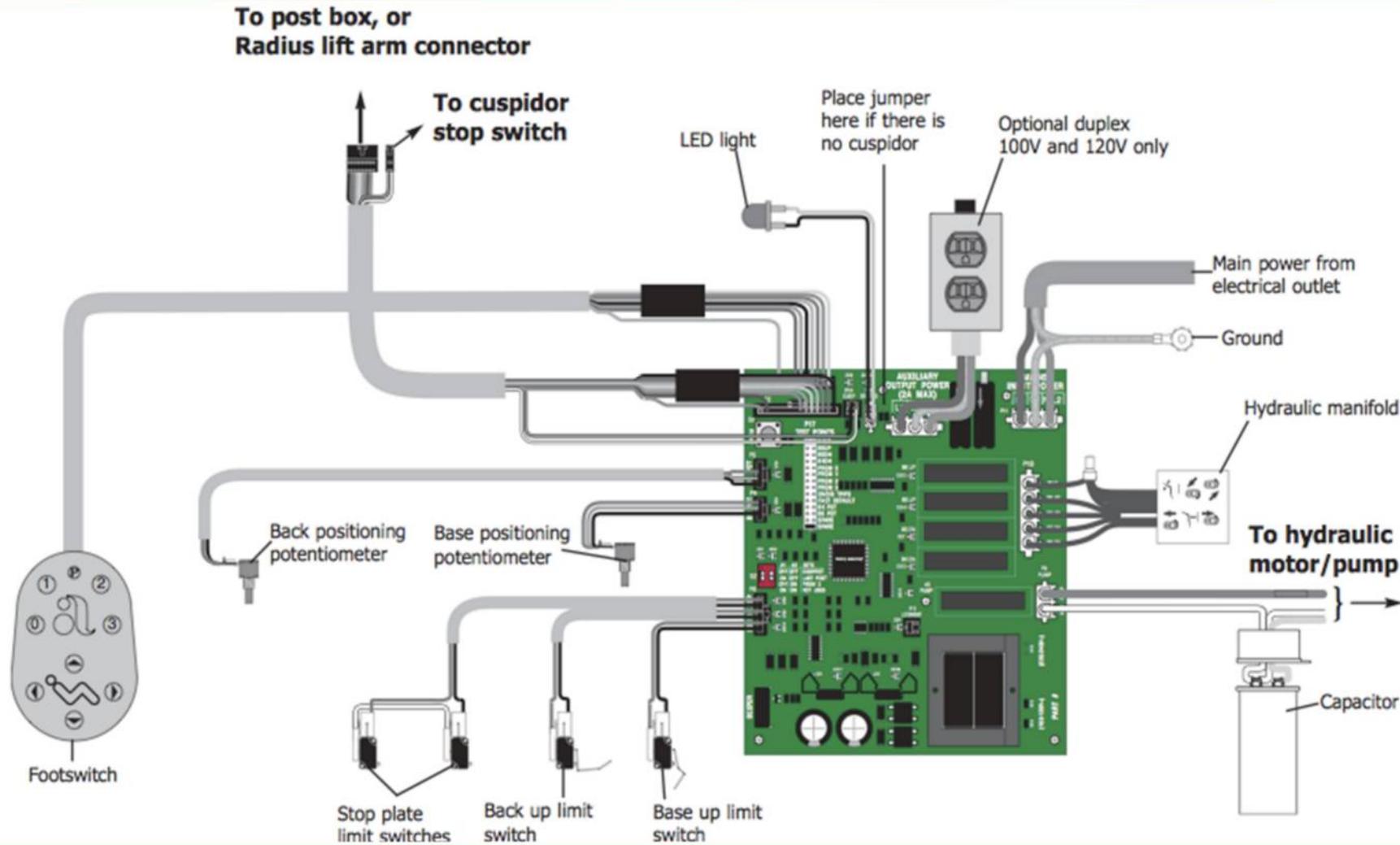
to tilt the seat of the chair up or down. Located at the front of the chair in the center. The seat can be adjusted by the doctor's center switch or the assistant's lower switch on either side of the chair back.



Back Motor Assembly

to recline or tilt the back of the chair up. It is located at the front right of the cradle assembly as viewed from the rear. The back can be reclined or tilted up using the switches located at the top of either the doctor's or the assistant's side of the chair.

Dental chair: Construction: Electric wiring



example:
A-dec chair

Dental chair: Controls

Doctor's Controls

located on the back rest on the right side of the chair (viewed from the back)

- (1) uppermost switch ☾ back adjustment
- (2) center switch ☾ seat adjustment
- (3) bottom switch ☾ automatic operation to “exit”

Assistant's Controls

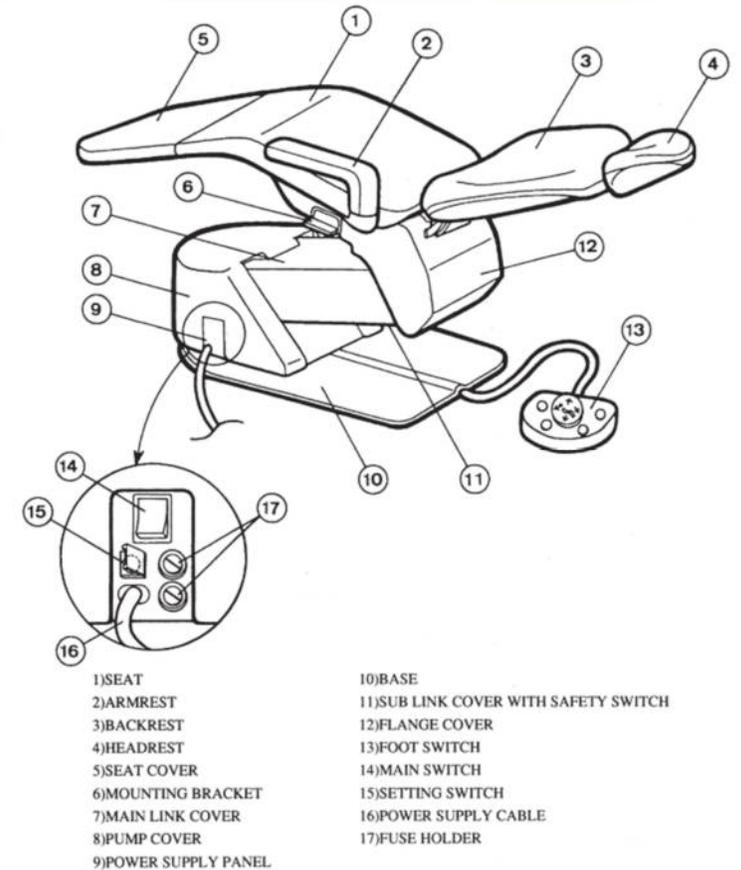
two switches on the assistant's side (left) of the chair

- (1) same function as the doctor's controls (except doctor's bottom switch)
- (2) the AUTO/MANUAL mode toggle switch under the chair. The doctor's lowermost switch only operates if this toggle switch is set to AUTO.

Pedestal Controls

one foot switch at the rear of the chair that can be operated from either side:

- forwards to raise, backwards to lower the chair



Dental chair: Preventive Maintenance (once per year)

Visual inspection of:

- 1) mounting brackets, arm rests, supports and pedestal frames: make sure that these are securely attached, operate correctly and have adequate strength to support the patient
- 2) control knobs, mechanical locks and levers: make sure that these are securely attached
- 3) nuts, bolts, screws and other hardware to be tight and in good condition
- 4) electrical connectors (jacks, receptacles and plugs) to be free of cracks, breaks, and properly attached
- 5) cables and cords will be free of splices or frayed insulation
- 6) cables, clips, studs and terminals will be free of dirt, dust, corrosion, and will not be worn
- 7) the grounding system will be of an approved type, properly installed and functional
- 8) switches, circuit breakers, fuse holders, and indicators will be free of dirt, dust, corrosion and not worn
- 9) all solenoids will be mounted securely in place and will have acceptable lead dress
- 10) all electrical components will be properly mounted and will operate without overheating
- 11) all hydraulic fittings will be tight and free of leaks

Dental chair: Preventive Maintenance (2)

Performance testing factors

- 1) Indicators such as pilot lights shall operate correctly as specified by the manufacturer's operating manual
- 2) Appropriate specific responses of the user controls
- 3) The ground impedance from chassis to power connector will not exceed 0.1 ohm
- 4) Leakage currents will be measured in the following modes: a. power off b. power on where possible each mode will be tested with the line cord attachment: c. properly grounded d. ungrounded, correct polarity e. ungrounded, reversed polarity. The measurements will be taken from chassis and controls. The power-on and power-off measurements will be the combined AC and DC instrument leakage currents.

Environmental Inspection factors

- 1) The electrical distribution will be inspected and tested to insure that:
 - a. Voltage level is adequate.
 - b. Receptacle polarity is correct
 - c. Receptacle ground is present
 - d. Receptacle has mechanical integrity
- 2) Mechanical clearance between the dental chair and other instruments, apparatus and devices
- 3) Shelves, cabinets

Dental chair: Trouble shooting: find the service doc !

Problem	Action
Chair is inoperative	<p data-bbox="670 379 1989 418">1 Do any relays on the printed circuit board click? Refer to <i>Testing Relay Click</i>.</p> <p data-bbox="774 425 1156 464">YES: Go to step 2.</p> <p data-bbox="774 468 1156 506">NO: Go to step 3.</p> <p data-bbox="670 554 1345 592">2 Is the base/back all the way down?</p> <p data-bbox="774 596 1651 635">YES: Go to <i>Base or Back Up Function is Inoperative</i>.</p> <p data-bbox="774 639 1156 678">NO: Go to step 3.</p> <p data-bbox="670 725 1447 763">3 Has the solenoid fuse blown (120V only)?</p> <p data-bbox="774 768 2372 849">YES: Replace the fuse. Check for shorted solenoids or shorted wiring to the solenoids (refer to <i>Testing Solenoid Continuity and Testing Wiring Harness Continuity</i>). Retest chair functions.</p> <p data-bbox="774 853 1156 892">NO: Go to step 4.</p> <p data-bbox="670 939 2262 978">4 Complete the steps outlined in <i>Testing Magnetic Pull</i>. Is there magnetic pull at each solenoid?</p> <p data-bbox="774 982 1156 1021">YES: Go to step 5.</p> <p data-bbox="774 1025 2117 1106">NO: Remove and replace the faulty solenoid (refer to <i>Removing a Solenoid and Replacing a Solenoid</i>). Retest chair functions.</p> <p data-bbox="670 1153 1276 1192">5 Is the chair in hydrostatic lock?</p> <p data-bbox="774 1196 2303 1235">YES: Remedy hydrostatic lock (refer to <i>Correcting Hydrostatic Lock</i>). Retest chair functions.</p> <p data-bbox="774 1239 1742 1278">NO: Check for and replace a faulty manifold or valve.</p>

example:
A-dec chair

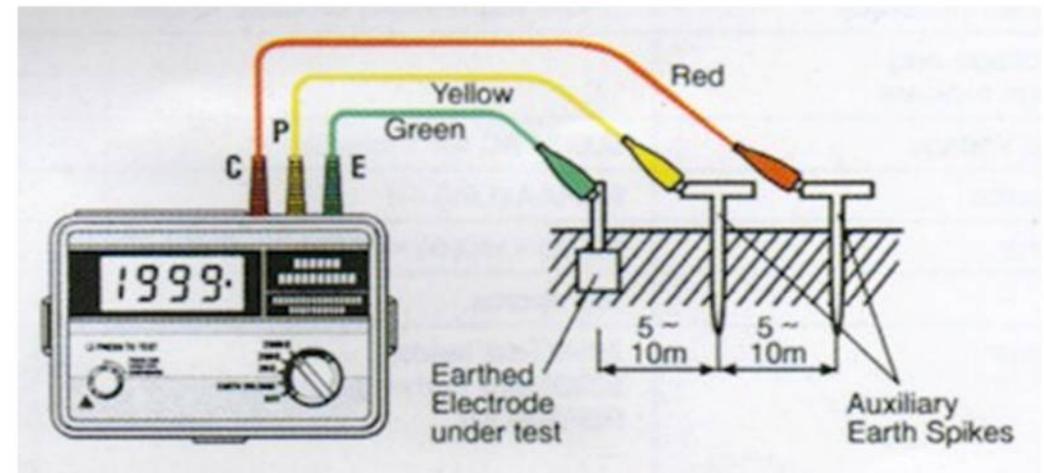
Dental chair: Safety considerations

All dental chairs involve risks to both the patient and the dentist. The major hazard is **mechanical** and is present in all patient-lifting, -moving, and -positioning:

- e.g. armrest, backrest or footrest failing.
- fingers can be caught in closing angle while moving the chair in upright position.



In addition, there is an **electrical** safety hazard: integrity of **grounding**, including controls, power cables, hydraulic system, backrest, footrest, armrest, pistons, seat



END

The creation of this presentation was supported by a grant from THET:

see <https://www.thet.org/>



PARTNERSHIPS FOR GLOBAL HEALTH
