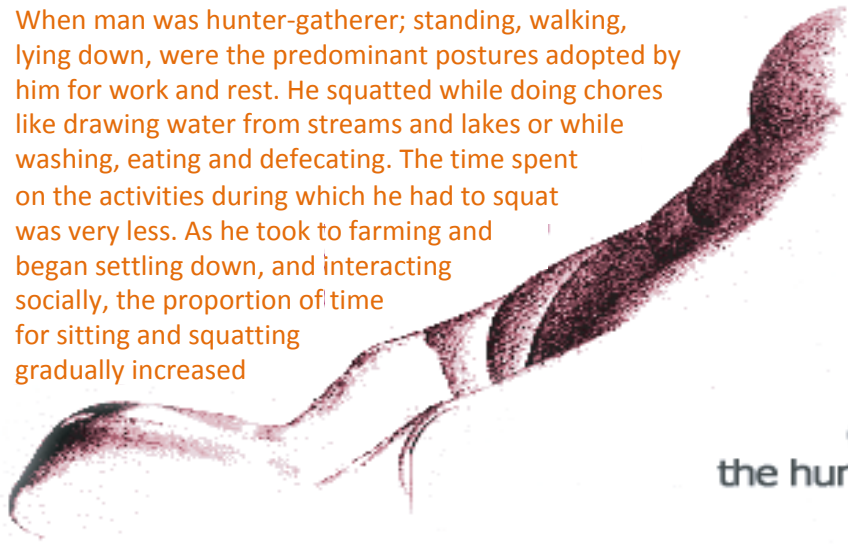


When man was hunter-gatherer; standing, walking, lying down, were the predominant postures adopted by him for work and rest. He squatted while doing chores like drawing water from streams and lakes or while washing, eating and defecating. The time spent on the activities during which he had to squat was very less. As he took to farming and began settling down, and interacting socially, the proportion of time for sitting and squatting gradually increased



CHAIRS the human factor

Life without chair is almost inconceivable these days. Not only is chair an object of utility, but a significant part of modern life as a cultural object. It signifies many things like power, authority, dignity, affluence and of course comfort and efficiency. Chair as a concept has a long history and has been in use in the form of swings, thrones, cushioned platforms, with back and side rests. In its modern avatar, chair is gaining wide acceptance even in societies where squatting is a preferred posture.

Due to widespread presence and **extensive use of the chair**, and its importance in our lives, it has become an object of investigation particularly by Ergonomists or Human Engineers, to make sitting comfortable, and the **work place efficient and healthful**. After the World War II, which threw up many issues regarding health and efficient man-machine interface, lot of research has been carried out on **sitting posture and seating (Chair)**.

We are still trying to find an ideal chair, which takes care of all the problems associated with sitting. From the list of health issues created by sitting posture, it appears that human being is not made to sit on a chair. Due to the modern life style, we adopt the use of chair and sitting posture for more number of hours than any other posture with all its attendant problems.

Per capita availability of chair in modern societies is very high, could be of the order of 5 or even more. This is because a person has a lounge chair, a dining chair, a study chair at home, a chair in the office and one in someone else's office, where he visits; in the canteen, club, bar or theatre and stadium, in the train and bus, besides having a bench in the park and one more at the bus stand.



Why do we sit?

When we stand, particularly in a work related situation for long durations, **many muscle groups contract**, that is, they work hard to keep our joints of the foot, knee, hip and the spine locked to maintain the posture. Blood and fluids tend to accumulate in the lower limbs. The heart has to work harder to pump blood over a greater vertical distance from the toes. A standing person, therefore, spends a lot of energy even without doing any work. This higher energy consumption and accumulation of certain chemical products (lactic acid etc.) in the contracted muscle groups causes fatigue and pain. **To relieve this fatigue we sit.**

Sitting takes the pressure off our feet, legs and excess workload off the heart. The back support and armrests of a chair keep the back and the shoulder muscles relaxed. The result is that the body spends much less energy. Though this could be achieved by lying down, we cannot lie down anywhere; so we invented a **dignified intermediate posture - sitting on a chair.**

Certain tasks necessitate a sitting posture. These tasks are essentially compulsions of modern life-style - Reading, writing, working on computer, having extended conferences, watching television, flying in airplanes etc. Sitting is necessary for **performing effectively** those tasks, which require **free and precise body movements**, like watch repairing, diamond polishing or driving vehicles. Sitting posture with proper supports, **gives stability to the body**, therefore good for operating foot controls.

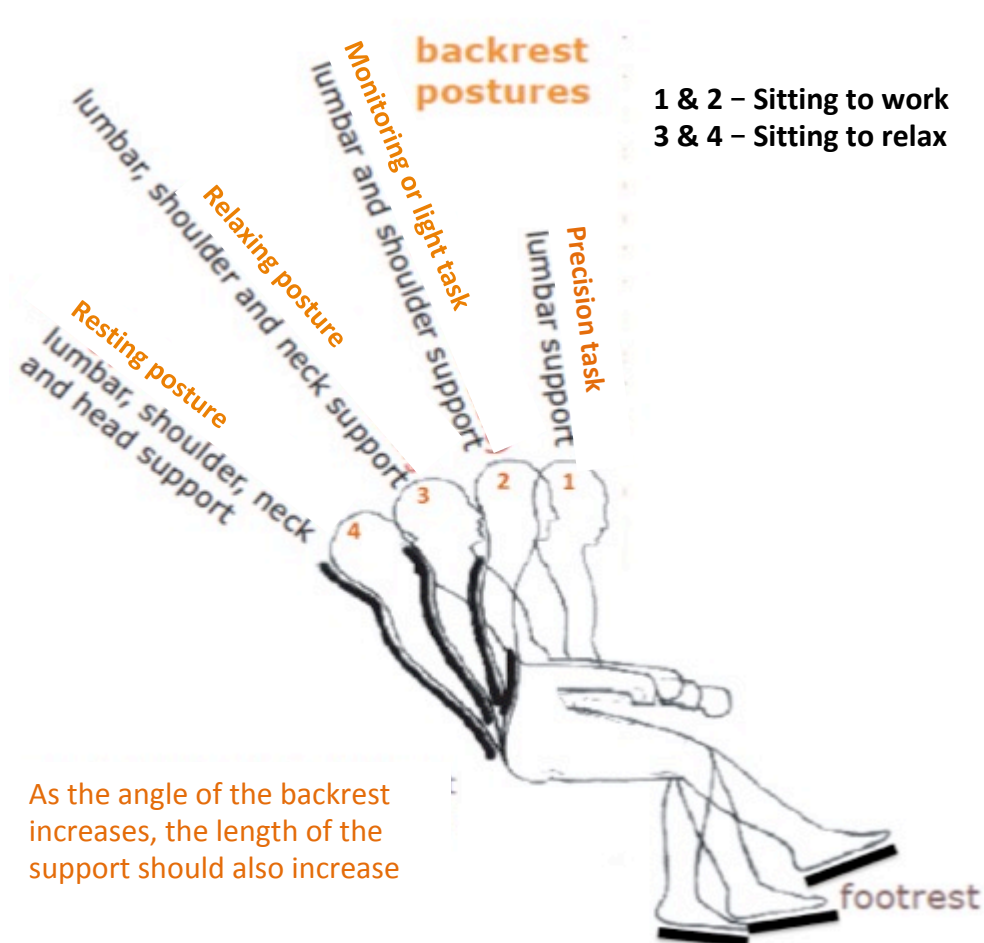


We can conclude that a seat or a chair is a device, which helps us to perform many tasks more effectively without unduly tiring ourselves.

Sitting postures

1. Sitting to work at a surface, like writing, typing, cutting vegetables or assembling electronic parts, driving a vehicle, repairing a watch or eating at a dining table, with full concentration and attention to the task at hand. When attention levels are high, torso tends to bend forward.

2. Sitting to work without a work surface, as while knitting, reading a book in hand, sitting to monitor (watching things happen) like watching television, or games in a stadium, or a concert in a theatre, in a tourist bus; sitting in front of a display panel to monitor various functions of an industrial plant, with some amount of attention.



3. Sitting to relax, like leaning back in a chair during work break at office, or at home after a day's work, or watching television, or in a park.

4. Sitting to relax fully, like leaning back completely in a chair, almost in a supine position, for a nap, or in a waiting lounge or listening to music with closed eyes.

In each of the above categories, the posture is different. So, there should be different types of seats for each. As we move from category 1 to 4, the angle of the backrest should increase with respect to the vertical; the level of comfort increases because we move towards a supine posture from an upright position.



Why we do not sit – Limitation of sitting

Despite many advantages, sitting is disadvantageous in some respects. One of the major disadvantages is that it **restricts movement of the body**.

Sitting is not comfortable work posture for many kinds of tasks, for example, pumping air into bicycle tubes, or flying a kite or planing a piece of wood – the tasks which need body movement and application of body force. It is also not comfortable to sit in case you have to get up too soon, or too often. That is why many people **prefer to stand in a bus**, if they have to alight at the very next stop.

Sitting and getting up, costs energy. Lower a seat, more is the energy you spend for getting into it or getting out of it. If one has to get up too often, one would use a tall seat or a stool, so that the vertical movement from sitting to standing position is minimal. When such a seat is not available, one just leans against walls, railings etc. to relieve the muscles from prolonged contraction caused by standing posture. One would observe such behavior in bus stands where benches are not available.

Prolonged sitting causes **abdominal muscles to slacken and curves the spine**. It impairs the function of some internal organs; particularly of digestion and respiration because of the constriction it creates. Prolonged sitting (over 60 minutes) in a chair produces swelling in the lower legs due to increase in hydrostatic pressure in the veins, and obstruction to the blood flow, by compression of the thighs. It is therefore recommended that one should get out of the chair and **stretch at regular intervals**.

A good (work) chair

An all-purpose chair does not exist, but one can have a **good chair to suit individual tasks**. One must definitely **avoid using chairs that force us to adopt** the wrong posture.

A criterion for selecting a **good work chair** is that while sitting the feet should touch the ground properly. In a high chair, the feet and legs dangle, the pressure under the thighs increases, hampering the blood flow to the legs and making them numb. In a low chair, the thighs are not adequately supported. This causes fatigue. A low work chair forces the body to have acute angle between thigh and torso, which is not good for spinal health and internal organs. Seat should therefore be such where **angle between torso and thigh** should be more than 90 degrees.

The **lumber and upper back should be adequately supported** so that the spine remains in **natural [S] position**. [S] is naturally adopted by human body, when one is standing straight or when one is sitting on a horse back. It is important that small of the back (lumber) should be supported by the backrest, **even when one is leaning forward** due to the demand of certain tasks, to help retain the [S] spine posture. It will be advisable to have a seat which tilts forward, to **maintain torso to thigh angle at 90 degrees or more**.

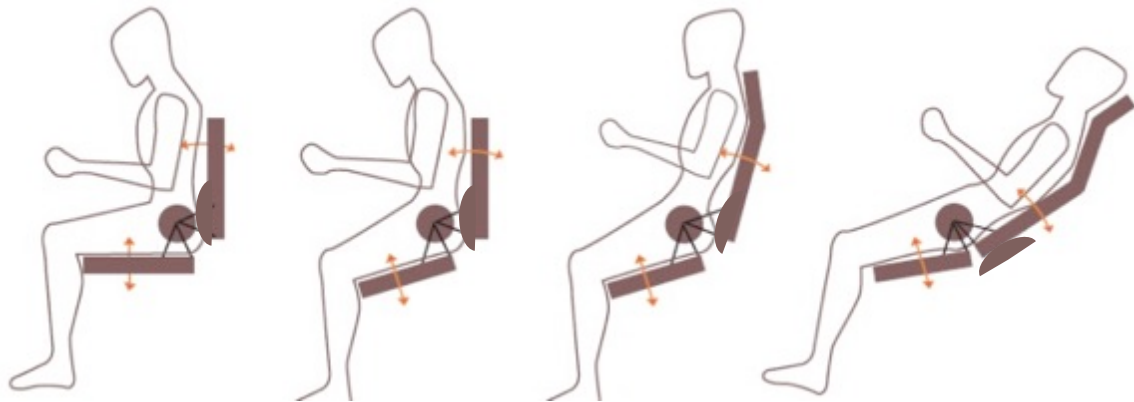
The seat and backrest **should allow and facilitate movement** of the upper as well as lower part of the body, and at the same time provide adequate support to the pelvic region, thigh region as well as lumber.



In a good chair, the **seat and back of a chair should articulate independently** and the pivot of articulation should match **the hip point**. This is to ensure that the body curve and the curve of the chair do not mismatch during various postural changes that one adopts while sitting & working.

While the feet should remain **firmly on the ground for the stability** of the body on the chair, the **legs and feet should also move** for proper blood circulation to the legs and feet to avoid numbness.

The length of back-support and the angle (with respect to the vertical) of the back-support should increase as we go from category 1 sitting postures (chair with table) to category 4 sitting postures (rest chair). While one is just monitoring (category 3), the backrest should be long enough and appropriately contoured to support the upper part of the back, shoulders and neck. Lumbar should always be supported even when the sitting person bends forward (Category 1) to perform a special task.



For the **relaxing posture** (category 4) the backrest should be high enough to support the neck as well as the head. The angle from the vertical could be as much as 60 degrees.

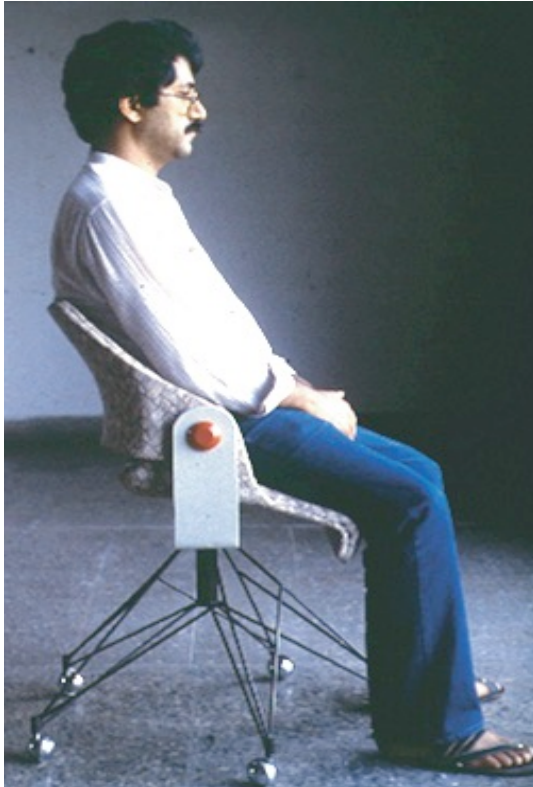


A negative or recessed head support where the back of the head rests in a wedge-shaped recess, **prevents the head from drooping sideways.**

This type of head support is also **useful for bus and airplane seating** as it **firmly holds the head and stops head wobble**, caused by sharp turnings or vibrations. It also **prevents nausea.**

For long duration sitting, **armrests are important for supporting the arms**, as the unsupported weight of the arms causes fatigue in the shoulder muscles. Without armrest, one tends to support the arms on the worktable, bending the torso forward, and **adopting the [C] posture of the spine, which is detrimental to health of the spine.** Armrest should be at a position, which allows the **upper arm to remain vertical** and forearm at a slight obtuse angle from the vertical. If there is no armrest or table to support the arms, the tendency is to lock the arms around the chest, which puts pressure on the rib cage and lungs, **thereby hampering normal breathing.**

While sitting on a **good chair** and the **feet resting on the ground**, there should be **minimal gap** between the front of the seat and inside of the the knee end of the thighs. The front part of the seat should be well rounded and soft so that it **does not dig into the inside of the knee**. The **depth of the seat** should be such that while keeping the feet on the ground, **the lumber** (the small of the back) should touch firmly **against the backrest**.



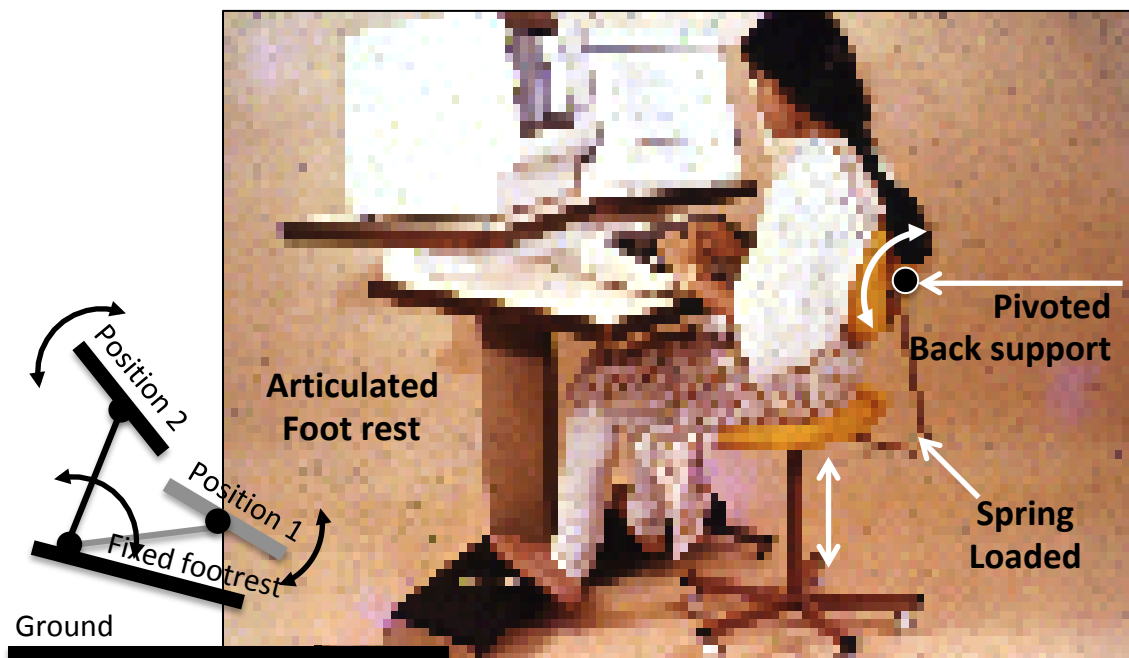
The seat **should be cushioned** with a **soft but firm material** so that pressure on the buttocks is evenly distributed. If the cushion is very soft and thick then one sinks into it. This makes it difficult to get out from. If the cushion is soft and thin, the buttocks touch the hard surface underneath, thereby losing the effect of such cushioning. The **upholstery should be textured to prevent slipping** and should preferably be made of woven materials (cottons and handloom cloth) so that it **breathes and ventilates**. The backrest should also be cushioned for full support, but the cushioning material should be softer than that used for the seat.

The lack of support at lumber region due to improper seat depth or wrong contours of the backrest **can cause back pain**. If the **contours of the seat and back are well designed** and appropriate, the cushion thickness can be minimal.

Change of Posture - Articulated footrest

A chair should allow for changes of posture and for flexing the trunk, legs, feet and arms. This can be achieved by providing "**articulated footrest**". Articulated footrest can offer this possibility of leg and foot movement. The articulated footrest can be part of chair or part of the worktable. Independent footrests or footstools or ottomans also allow the lifting and lowering of the feet.

Another way to cater for postural changes is, to provide spring loaded and/or pivoted backrests. Pivoted and forward inclinable seats help in stretching the body and changing the posture periodically.



Legroom is an important factor for postural change. In confined places like buses, trains, airplanes and theatres, **inadequate leg room restricts postural changes**, hampering the stretching of body and legs. This is one of the definite causes of fatigue and pain

Problem also arises when **we do not find an appropriate chair** for the task at hand due to lack of economic resources, **lack of concern or lack of knowledge**; and therefore make do with whatever is available. **Bad seat is a result of lack of concern.** A nice looking cushioned seat, in a luxury bus or train, which does not give adequate support (lumber, neck & head) where it is needed, is **an example of lack of knowledge.**

A good chair should therefore provide all the advantages and avoid disadvantages.

Choosing a chair

While sitting upright, feet should get **firm support from the ground**

The backbone should **hold the natural [S]** curve while sitting

The back should be supported well, particularly at the lumbar region – check this by **putting your hand between the lumbar and back of the chair**. There should be minimal or no gap

Seat depth should be such that **lumbar can touch the backrest** without pinching the inside of the knee

Height of the backrest should be chosen according to task involved. However for **intermittent rest during long sitting periods**, higher backrest should be chosen

Backrest should be **appropriately contoured to fit the body curve**

The cushions should be minimal but adequate - **firmer on the seat pan and softer on the backrest**.

Front edge of the seat should be **well rounded**

The upholstery should be woven and it should **breathe**

Independent articulation of seat and backrest is desirable

The chair should allow you to **adopt variations in postures**

During **forward leaning** postures, the **backrest should touch the lumbar**

Dispense with the **armrest** only if the task demands it

Footrests should be looked for – needed for postural change and **movement of lower limbs**

Appearance of comfort or thicker cushions, do not always mean comfortable chairs – appropriate contouring is important (Sit in it, feel it, try it and then use it)

Irritants should be looked for. In a good chair you should find none, and you should be able to forget yourself when you sit in it

A good chair should be interactive - responding to the body movements and facilitating correct posture, particularly during work and during rest. The properly contoured seat as well as backrest should independently move about a point, which corresponds to the hip joint of the body. It should allow the feet to rest firmly, and also allow their movement.