



New For Old

# Portable Posture

## Final Product & Production Report

By Eva McSweeney



# Introduction

## 1.0 Introduction

Our design team was given the brief below, new for old. With this brief we had to decide who our target market was, to research them and produce concepts for products which we felt best served their needs. As a group we decided to break our research up into different areas of the elderly person's life, travel, comfort, medical and everyday products. I researched the area of comfort and in doing this found that it led me towards the medical aspects of their lives as health plays a big part in the comfort of the elderly.

I chose to design a seat aid as I found that the existing ones on the market were uncomfortable, boring, and over priced for what they did. I also found that they had limited functions and while they might relieve one ailment they hindered the recovery of others. In doing my research I conducted interviews with orthopaedic surgeons, physiotherapists, and nursing staff of the elderly. I found that the main issues were lower back pain and pressure sores. I also found that the cause of these ailments was due to a lack of frequent movement of the spinal column. As I was designing a product which was to adapt to the human body I did extensive ergonomic research. In doing this research I feel that I learned a lot about seating and its problems, because of this I feel that my final product encompasses all that it can in regard to promoting better posture and frequent movement of the spinal column, whilst relieving lower back pain and pressure sores.



Fig 1

**‘All sitters should move around, in addition to helping muscles relax and recover, this alternatively squeezes and unsqueezes the intervertebral discs, which results in better filtration of fluids in and out of the cores of the discs. Discs stay plumper and in the long run healthier’**, Jonathon Cluett M.D, orthopaedic surgeon

The final product is a lightweight portable seat aid which can be used on any chair, and car seat. The portable posture is designed so that when the user sits on it, it locks the sit bones into place and therefore can be used on seats with no back. It is designed so that the user can rock forward and back, and change their position and therefore their posture as frequently as is needed. Techno gel padding is used to relieve pressure on the sit bones by 40% more than the commonly used foam. One of the main pressure points is eliminated as the tail bone is suspended in an open space. The design also supports both legs individually so that they can move independent of each other, this is especially designed for cars to aid the changing of gears, breaking, and accelerating.

**‘In the conventional sitting position, the weight of the head and torso is carried down to the bones of the pelvis and hip. The timeless problem associated with this is however much a seat may be softened; the pressure of the bones will eventually be felt on the flesh of the buttocks as uncomfortable. Ultimately this results in the user having to change positions – something, which is done on average every ten to fifteen minutes. Indeed, the more exactly a chair is formed to give ‘ideal’ static support and posture to the average human frame, the more it guarantees discomfort for people with non standard anatomies or those who do not wish to assume that particular position. It is probably safe to say, therefore, that while the facility for correct lumbar support is important, it is not as crucial as the chair allowing the user to move their legs freely and to make frequent adjustments of posture. For more healthful sitting, a chair should thus facilitate freedom of movement and encourage a variety of postures while providing flexible continuous support.’** 1000 chairs, Charlotte and Peter Fiell.

## **1.1 The Brief**

New for old - Western demographics indicate a reversal of the pyramid model in social composition. With this in mind, propose a product range which appeals specifically to this expanding market sector.

## **1.2 Brief Breakdown**

If we look at the western demographics of the last century, we can see what is meant by this brief. At the beginning of the 20<sup>th</sup> century the social composition of new to old people was very different to what it is today. There was a high infant mortality rate and life expectancy was low. The workforce was able to sustain the elderly and young in society. Since then there has been a complete reversal of the pyramid. This is in part due to the introduction of contraception and a very low birth rate. Modern technology and medicine have also raised the life expectancy from 65 to 82+. Because of this we have an expanding elderly market sector.



# Market Research Data

## **2.0 Market Research Data**

### **2.1 Social factors**

#### **2.1.1 The past:**

In the past the elderly were seen as useless and sponges on society. They were considered redundant in the workforce and were encouraged to retire as soon as they reached an elderly age. They were seen as babysitters for their grandchildren, to allow their children to work towards retirement themselves. They were considered frail and weak. It seems as though they were expected to simply wait out the rest of their lives till death.

#### **2.1.2 The present:**

In today's society the elderly role is going through a dramatic change. They are becoming active members of society, becoming healthier and viewing retirement as a time to travel, explore and redefine themselves as people outside the work environment.

#### **2.1.3 The future:**

As life expectancy and levels of activity increase so will their role as productive members of society. Many enrol in adult classes, which show their willingness and ability to keep up to date with new technology and processes.

### **2.2 Growing old**

Growing old is something which we will all experience, but at what age? The defining age of when we turn old is 65 as this is the age of retirement. But some people are old long before this. A 6 year old they will tell you that their auntie is old; she could be 25 or 30. If you ask a 60 year old they will tell you 75 upwards. Old is a state of mind. Not an age.

In doing this report we decided that it would be a good idea to interview people of certain ages, to get a feel of how people view age, and growing old. Some people view it as a time of peace, a time to reflect on their lives, and a time to do things they never had time for. Others worried about financial issues, wrinkles, loneliness and

death. The main fears people had about growing old were loneliness, loss of independence and dignity.

### **2.2.1 Other cultures:**

In other cultures the elderly are highly respected and are looked to for advice and decision making. They are often called the elders of the tribe. Maybe we should look to these societies for inspiration and ideas.

## **2.3 Dependency**

### **2.3.1 Independent elderly:**

The independent elderly are people over 65 who don't have any dishabilitating illnesses. These people find once they retire that they have a lot more time on their hands. Pastimes they enjoy include bingo and card games, pets and gardening, walking and light exercise, charity work and coffee mornings, television especially daytime soaps and game shows which keep their mind active.

### **2.3.2 Co - dependant elderly:**

The co-dependant person is one who relies on at least one other person to get them through their day to day life. The co-dependant is physically or mentally unable to carry out activities to sustain their lifestyle. The co-dependant is usually 75 or older unless affected by an illness earlier in life. The care needed is usually provided by family members or home help care that give a range of help from driving the person and sorting their finances to cooking them meals.

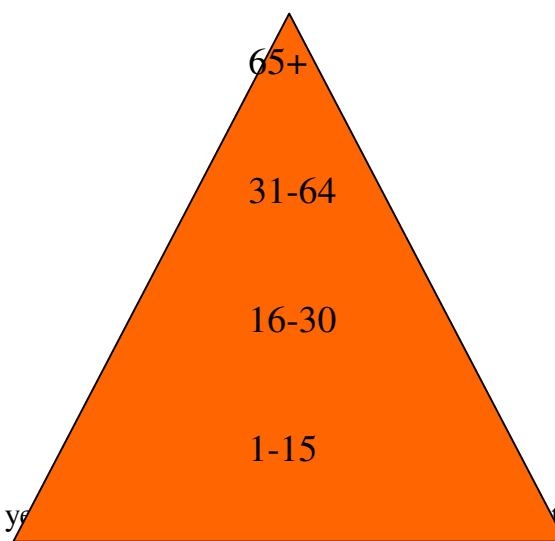
### **2.3.3 Dependant elderly:**

Possibly immobile or have restricted mobility, those people who are dependant on walking sticks and have some independence or those who are completely dependant on family/friends and nursing staff to get around. They live in retirement homes or require a stay at home carer. Financially these people have quite an expensive time, as health care is high. They have reduced awareness of the world around them.

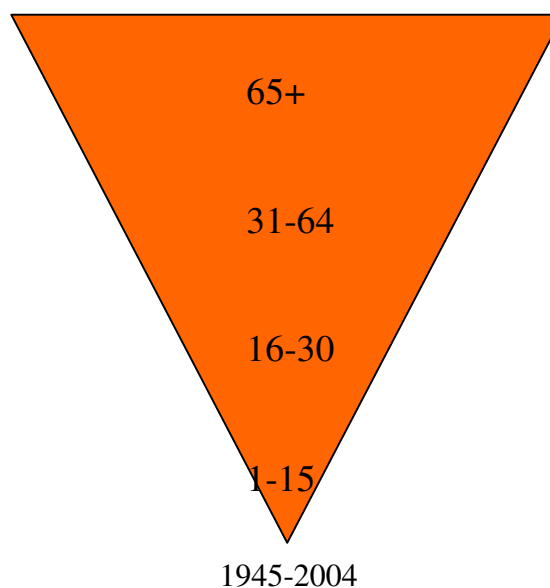


## 2.4 Demographics

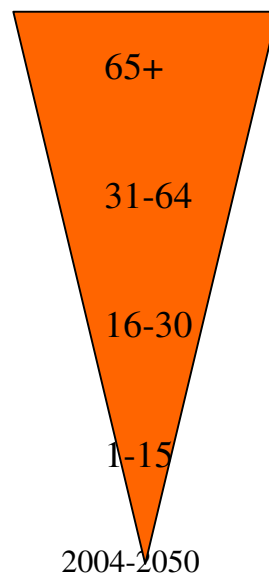
At the beginning of the 20<sup>th</sup> century the social composition of new to old people was very different to what it is today. If we look at the period between 1900-1945 the average family consisted of two parents and between 6 and 12 children. There was a high infant mortality rate and life expectancy was quite low at 65-67. This meant that there was a large amount of the population working and paying tax. Therefore it was quite feasible for the workforce to be able to sustain the elderly and young in society. The state had what was called 'from the cradle to the grave', which meant that you would be looked after by the state for your whole life.



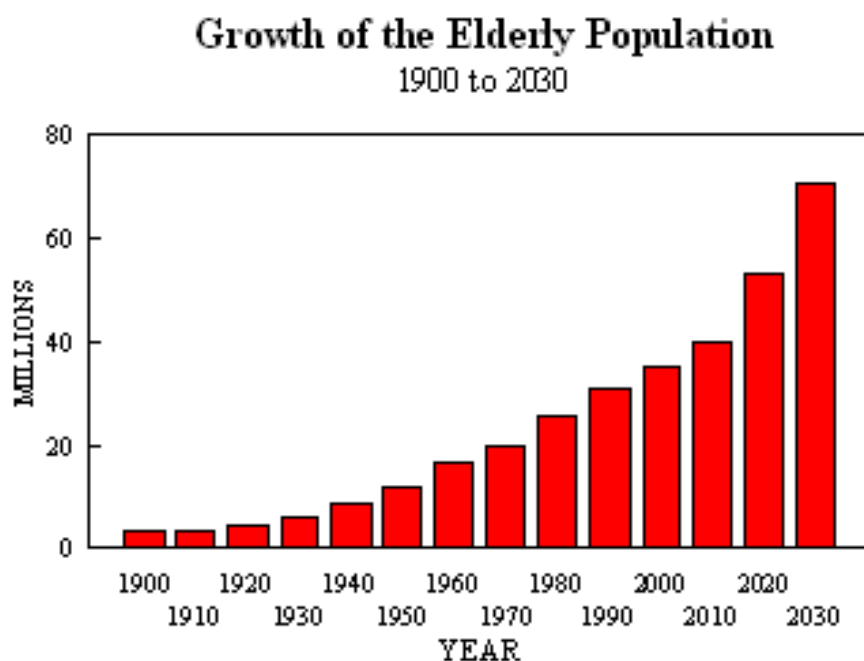
If we now look at the year 1945-2004, this pyramid. Fewer children are being born due to the introduction of contraception. The advances in medicine also raise the life expectancy to 82+. So now there are fewer people in the work force and a larger elderly population to be looked after.



If we look into the future this pyramid model is again going to change, there is a very low birth rate and the advances in modern technology have increased our life expectancy even more.



With this new pyramid model in mind we will look at this expanding market sector, the elderly in society today and in the future.



Source: U.S. Bureau of the Census

Fig 2

It has been found that in terms of worldwide population that the older a person gets the more gradual the population decreases; however with the help of this chart we can

see that the population is not as low as one would expect for the 50+ age group which can be classed as average up to the age of 75+. Through this world view it seems that when targeting an elderly target market the best age group may be the 50-75 age-bracket.

Seen above is a chart showing historical census data and possible future population growth up to 2030. This data only accounts for 20% of current elderly population in the U.S.A. during 2004. It is believed this is the case assuming that the Bureau of the Census compiled that the elderly is made up of the 65+ age bracket. However due to Western World Economic Growth it is fair to say that more professionals are proceeding to retire earlier to the years previous so it may be necessary to tag 50+ as elderly due to current economical factors. Even with this difference the Bureau of the Census does predict a 70% increase of the elderly population during the next 25 years within the U.S.A. With this high growth factor a prediction of at least 170million elderly people may be a possible target market within the next 25 to 30 years.

## **2.5 Mental health issues**

Mental health and illness are a dynamic and ever changing problem. The term mental illness refers to all mental disorders. Mental disorders are health problems that are caused by ways of thinking, moods, behaviour and stress. These conditions continue to change throughout life. There are different stages of every condition which are due to vulnerable forms of mental and behavioural conditions. Every day problems such as divorce, a death of a loved one and a job loss can create mental health problems. There are many common types of mental disorders to found amongst both young and old people. Below is a brief list of these disorders:

Anxiety Disorders affect approximately 10% of living adults. The main anxiety disorders are: panic disorder, obsessive compulsive disorder, post-traumatic disorder, social phobia, specific phobias, and generalized anxiety disorder. Though they all differ, they all share the same overwhelming irrational fear and dread.

## **2.6 Physical health issues**

We know that regular physical activity enhances our health and that research proves that it can both prevent and alleviate the effects of many common illnesses, such as arthritis, high blood pressure, diabetes, osteoporosis and asthma. Yet many people become less active as they age, and studies show that participation rates are low amongst older adults. Activities that are health enhancing include things you can do on your own such as walking, gardening, swimming and things you can do with a group, bowling, tennis or dancing. For the elderly, some need constant care to monitor their speed of processing, memory, and reasoning in preventing or postponing loss of independence. Some of the illnesses that they may suffer can be helped or even in some cases prevented if the person stays fit and healthy.

#### Physical Illness

As people get older they become much slower on their feet. Some might need to use walking sticks, Zimmer frames or even wheel chairs to help them get from place to place. Activities such as going to the kitchen to make the tea, or even going to the toilet can be very difficult for some. Old people might begin to feel that they are losing their privacy as they need help getting dressed and washing themselves. They begin to rely on other people more and more. As they get more unwell they still wish to stay as independent as they were when they were in their thirties. It is upsetting to see an old person wanting to be independent for themselves and just not being able to do so. Here are some examples of the physical illnesses that old people suffer with that may in some cases, take away their independence.

## 2.7 Techno phobia

Early Study has reported that elderly people were more anxious than younger people in terms of product technology, however research has identified that in many cases product technology is actually very useful to older retired individuals. Technology can ease their suffering in many cases as it may ease workload or stress levels when taking part in a particular daily exercise such as washing dishes or clothes.

Many tasks to the elderly seem difficult such as driving a car or using a computer, however this may not be about how hard it is to drive the car or use the computer but

the psychological impact of using technology to get something that early in their life seemed so straight forward.

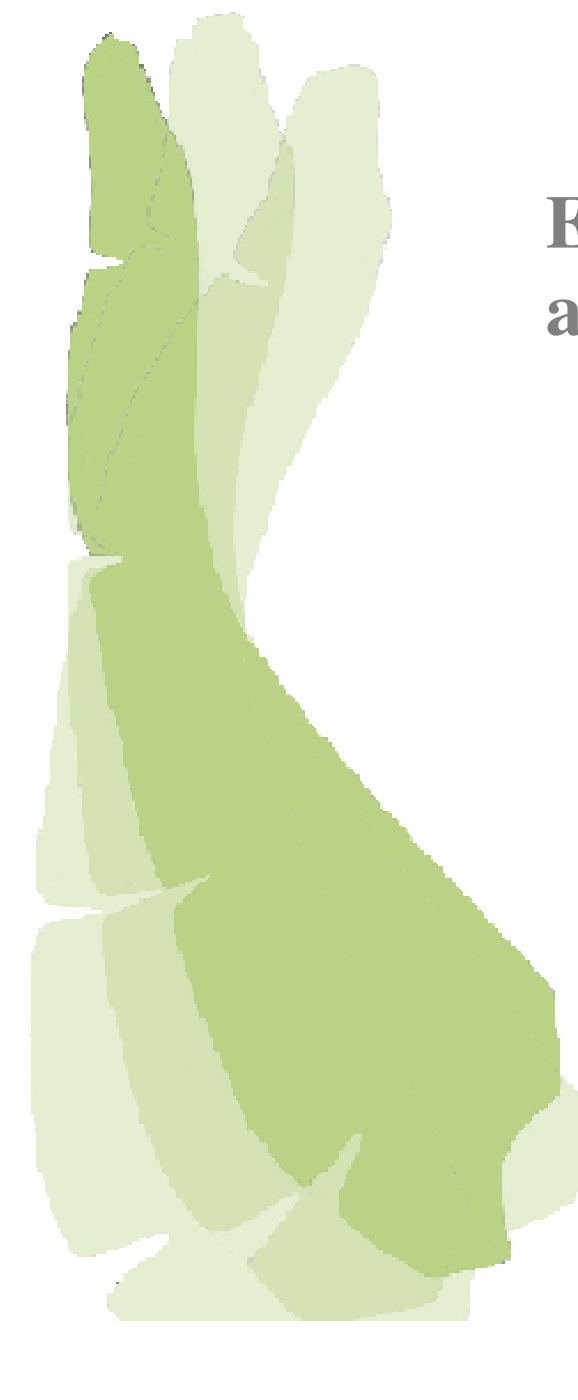
Also another factor may be how they perceived the elderly at such a young age, they may have thought that the elderly are in a word 'useless' and through this perception found a persona of learning difficulty through personal psychological perceptions. Other factors that may contribute to elderly anxiety includes how society perceives the elderly, as the elderly seem feeble and decrepit many do not look at this sector as being full of experience and knowledge if this was a priority a product could be produced around elderly knowledge which may ease social perceptions but also decrease elderly anxiety in an efficient and productive manner.

## **2.8 Organizations and services for the elderly**

Mental Health Services has changed dramatically over the last twenty years or so. These changes have been and are driven by government policies, changing patient populations, and the closure or dismantling of the large institutions. This has resulted in the development of better care and a more supportive service to those with mental illness.

## **2.9 Charter rights for the elderly in Ireland**

In 1982 the Irish Congress of Trade Union and the National Federation of Pensioners Association adapted the following principles in the plan of action on age. These rights were campaigned to ensure that the elderly can live in conditions of freedom and dignity.



## Ergonomic analysis

### 3.0 Ergonomic analysis

A person spends a good deal of his active life sitting. He sits to tie his shoes, he sits to eat breakfast, he may work eight hours a day, he commutes sitting in a subway, train, bus or car, and in the evenings he sits to watch television, to converse or to read. It is essential therefore that seats be properly designed for comfort and efficiency.

In spite of all the knowledge accumulated through research and tests by experts in the field, seating remains poor. Some chairs today look as though the designer never saw a human body, they neither do nor confirm to the body curves, they overload certain tissues to the point of fatigue, and do not support the hollow of the back.

This is a report to investigate all areas of ergonomics that apply to chairs and the elderly, with a view to improving them by designing a seat rest which adapts to different chairs and relieves the problems associated with bad chair design.

### 3.1 The Seat

Some primitive peoples have no knowledge of seats of any kinds; they crouch, kneel or squat. So where did seats come from? The anthropological answer is that they originated as status symbols; only the chief had the right to be raised up. Hence the gradual development of ceremonial seats, which indicated status by their size and decoration. This status function persists to the present day. There is for example, a wooden chair for typists, a thinly upholstered chair for the senior clerk, a thickly upholstered chair for the office manager, and for the directors a swivel armchair upholstered in leather.

At the beginning of the 20<sup>th</sup> century the idea gradually emerged that wellbeing and efficiency are improved and fatigue reduced if people can sit at their work. The reason is a physiological one. As long as a person is standing it requires an outlay of static muscular effort to keep the joints of the feet, knees and hips in fixed positions; this muscular effort ceases when the person sits down.

This realisation led to a greater application of medical and ergonomic ideas to the design of seats for work. This development gained in importance as more and more people sat down at their work, until today about three quarters of all operations in industrial countries have sedentary work.

### 3.2 The spine and lumbar region

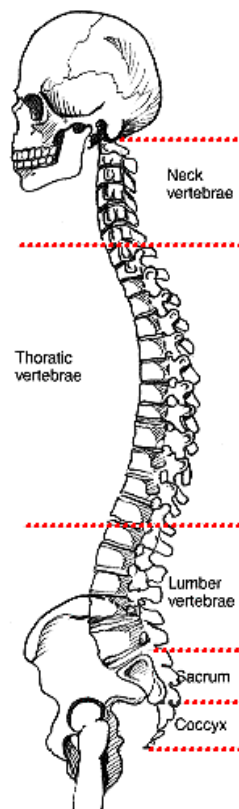


Fig 3

The spine is literally the supporting structure of the body. It has changed little since we decided to stand on our own two feet. The lower two vertebrae have grown more solid in time, an improvement exclusively found in human beings.

In profile, the spine is curved in a faint S-shape to help it cope with the different kinds of load. It is this natural form that should be supported during sedentary work. Any modern office chair can do this but there are natural limits to it. We are not designed to sit still like that even in the correct position, for long periods of time. The spine is well sprung with resilient discs between the vertebrae. The sacrum and coccyx cannot



move but moveable joints connect the 24 other vertebrae. Together they make a very elastic construction.

A wrong working posture, especially if you bend forward too much, will produce an uneven pressure on the discs. When the discs are “squeezed” out of shape, the surrounding tissue will compress or stretch. If the pressure becomes excessive, you may end up with a slipped disc. The outer ring of the disc will rupture so that the soft core will be squeezed out and press on the nerves.

Physicians use a code to number each of the 24 vertebrae in the spine. The low back officially begins with the lumbar region of the spine directly below the cervical and thoracic regions and directly above the sacrum. The lumbar vertebrae, L1-L5, are most frequently involved in back pain because these vertebrae carry the most amount of body weight and are subject to the largest forces and stresses along the spine.

Whether you are standing, sitting, sleeping, working, or relaxing, your spine is most comfortable in what we call a neutral posture. Neutral postures are positions about halfway between full bending and arching. Your neutral spine has three natural curves: an inward curve at the neck (cervical lordosis), an outward curve at the upper back (thoracic kyphosis), and an inward curve at the low back (lumbar lordosis). The amount of curvature in your spine when you are in a neutral posture determines your support requirements. A spinal support's curves should be deep enough to support your particular curves without pushing beyond your neutral postures. It should feel natural. You should not feel too arched; nor should you feel unsupported, as though there were a gap between you and the support.

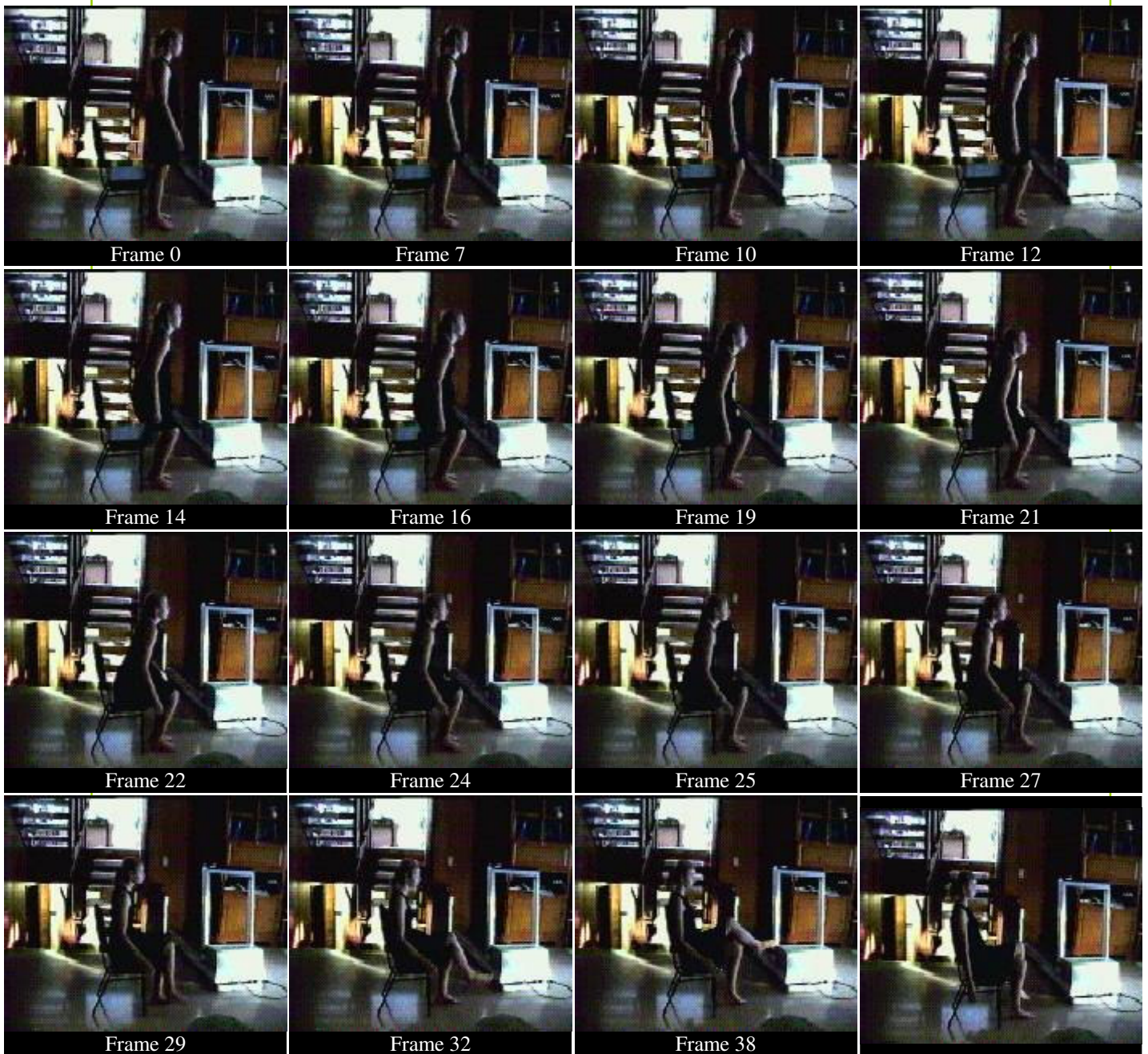
### **3.3 The sitting action**

Sitting is a posture in which the weight of the body is transferred to a supporting area by mainly the ischial tubersites and their surrounding soft tissues. Depending on the chair and posture, some proportion of the body weight is also transferred to the floor, the work surface, the backrest and the armrests of the chair.

When standing erect, the lumbar spine is lordotic partly because the vertebrae and discs are thicker anteriorly than posteriorly, and partly because the upper surface of the sacrum is at an angle to the horizontal plane. As the sacrum is firmly attached to the pelvis it follows that a rotational movement of the pelvis changes the sacral-horizontal angle and thus influences the shape of the lumbar spine. A forward rotation of the pelvis causes increased lordosis in order to maintain an upright trunk posture, while the backward rotation causes the lumbar spine to flatten and sometimes kyphosis (backward curvature of the spine) can develop. Typically when sitting the pelvis is rotated backwards, and the lumbar lordosis flattens. A group of muscles at the back of the thigh, the hamstring muscles, influence the configuration of the lumbar spine and pelvis because they run from the lower limb to the pelvis, crossing both the hip and knee joints.

In general, the posture of a seated person depends not only on the design of the chair, but also the task to be performed. Anterior sitting postures are adopted most often when deskwork is performed, while posterior positions are preferred for resting. The height and inclination of the seat of the chair, combined with the position, shape and inclination of the backrest, the presence of other types of support combine to influence the resulting posture.

As it is unlikely that there is a single ideal posture, and furthermore no body posture can be maintained indefinitely, it becomes important that alterations in one's posture also are permitted by the chair.



Fig

### 3.3.1 Sitting and the elderly

Products of today are generally designed for the physically perfect person. These products are often difficult or impossible for an elderly person to operate. With age comes decreased strength, muscle control and senses. Mental and physical diseases and disabilities also increase greatly with age. As designers it is our responsibility to

design for all. To do this we need to fully understand the physical capabilities and restrictions of the elderly consumer. The elderly of our target market of 50 to 70 years old will mostly still be active with many still working. Most will at this stage in their lives have fairly sedentary lifestyles so seating is important to them. They will have many of the problems associated with bad seating, as their bodies are more susceptible to damage. Bad seating can cause problems such as lower back pain, poor circulation, pressure sores and bad posture. Other factors which we must consider when designing for the elderly are osteoarthritis as the likelihood of this increases with age also we must consider artificial hips and their spines are not as flexible as younger persons.

### **3.3.2 Advantages of sitting**

- Taking the weight off the legs.
- Ability to avoid unnatural body postures.
- Reduced energy consumption.
- Fewer demands on the blood system.

### **3.3.3 Disadvantages of sitting**

- Prolonged sitting leads to a slackening of the abdominal muscles
- Leads to the curvature of the spine, which in turn is bad for the organs of digestion and breathing.
- Bad backs, acute and chronic
- Deteriorated intervertebral discs
- Pressure sores

## **3.4 Detailed view of problems associated with seating**

### **3.4.1 Curvature of the spine**

We're all born with natural curves in our back, but take a look at your spine from the back on an x-ray and you should see a straight line, like the letter "I". An x-ray that

reveals a spine with a sideways curve, like the letter "C" or "S", could spell trouble. Curvature of the spine is a catch all term for a number of conditions, but the one associated with improper seating is Kyphosis.

Kyphosis is an exaggerated curve of the back that looks like a rounded or hunched back could be kyphosis, according to AAOS. Kyphosis might develop as a result of slouching. Poor posture can stretch spinal ligaments. It is more common among females than males.

### **3.4.2 Bad backs, acute and chronic**

Lower back pain is characterised by pains or aches situated from anywhere between the bases of the back of the ribs to the top of the legs. The pain can come on slowly but more often than not, begins suddenly. It can be made even worse by bending, sitting badly, turning in bed and even coughing or sneezing. The usual cause of lower back pain is muscle stress and strain but it can also originate from ligament, tendon or vertebrae damage, posture, feet positioning amongst others.

Lower back pain is often described in three categories. Acute when it has lasted less than 6 weeks, Sub-acute if it has lasted between 6 - 12 weeks and chronic if it has lasted longer than 12 weeks. Most people will have at least one backache during their lives, and many will live with recurrent or prolonged back problems. While discomfort can affect any area of the back, pain most often afflicts the lower part, which supports most of the body's weight.

### **3.4.3 Deteriorated intervertebral discs**

Intervertebral discs begin deteriorating and growing thinner by age 30. One-third of adults over 20 show evidence of herniated discs (although only 3% of these discs cause symptoms). As people continue to age and the discs lose moisture and shrink, the risk for spinal stenosis increases.

### **3.4.4 Pressure sores**

Pressure sores are areas of injured skin and tissue. They are usually caused by sitting or lying in one position for too long. This puts pressure on certain areas of the body. The pressure can reduce the blood supply to the skin and the tissues under the skin. When a change in position doesn't occur often enough and the blood supply gets too



low, a sore may form. Pressure sores are also called bedsores, pressure ulcers and decubitus ulcers. Pressure sores usually develop over bony parts of the body that don't have much fat to pad them. Pressure sores are most common on the heels and on the hips. Other areas at risk for pressure sores include the base of the spine, the shoulder blades, the backs and sides of the knees.

### **3.5 Other problems related to sitting**

The incidence of low back pain and sciatica increases in women at the time of menopause as they lose bone density. In older adults, osteoporosis and osteoarthritis are also common. With the onset of osteoporosis and osteoarthritis comes the likelihood of replacement hip surgery

#### **3.5.1 Osteoporosis**

Osteoporosis is a disease in which bones become fragile and more likely to break. If not prevented or if left untreated, osteoporosis can progress painlessly until a bone breaks. These broken bones, also known as fractures, occur typically in the hip, spine, and wrist. Any bone can be affected, but of special concern are fractures of the hip and spine. A hip fracture almost always requires hospitalization and major surgery. It can impair a person's ability to walk unassisted and may cause prolonged or permanent disability or even death. Spinal or vertebral fractures also have serious consequences, including loss of height, severe back pain, and deformity.

#### **3.5.2 Artificial hips**

There are many different shapes, sizes, and designs of artificial components of the hip joint. For the most part these are composed of chrome, cobalt, titanium, or ceramic materials. Some surgeons are also using custom-made components to improve the fit in the femur.

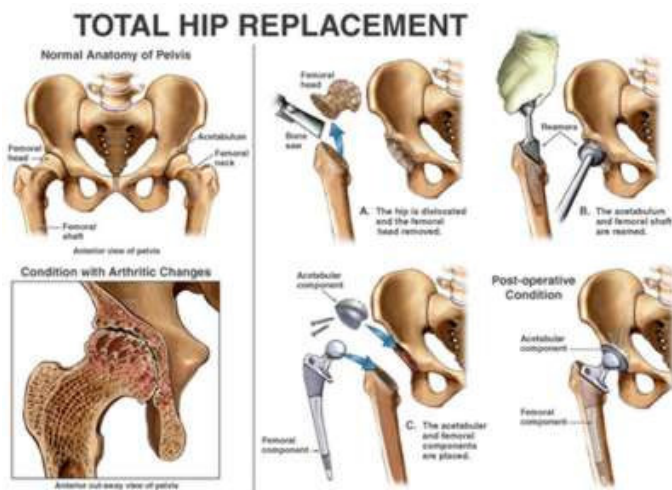
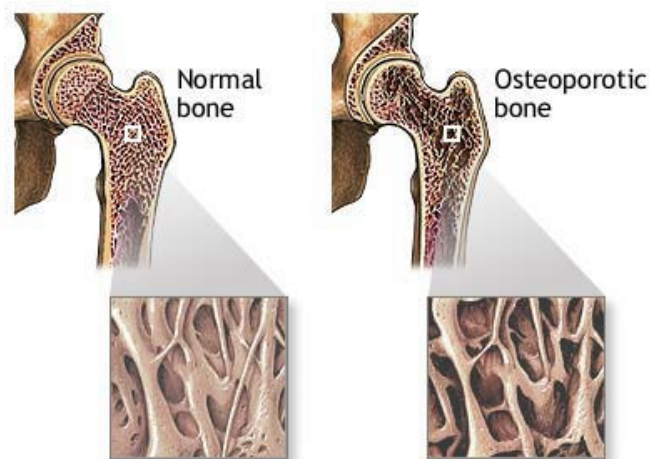


fig 5

### 3.5.3 Osteoarthritis

Osteoarthritis occurs in joints where cartilage is damaged and then destroyed, usually as a result of aging. In reaction to this destruction, the bones associated with the joints develop abnormalities. When osteoarthritis affects the spine, it may damage the cartilage in the discs, the moving joints of the spine, or both. The nerves may become pinched, causing pain and in advanced cases, numbness and muscle weakness. The patient may also experience muscle spasms and diminished mobility.



ADAM. fig 6

### 3.6 Orthopaedic recommendations

- The seat should be tilted backwards so that the buttocks will not slide forward. A tilt of 14-24 degrees to the horizontal is recommended.
- The backrest should be inclined at the following angles:  
To the seat                      105-110 degrees  
To the horizontal            110-130 degrees
- The backrest should be provided with a lumbar pad. The apex of this pad should meet the spine between the third and fifth lumbar vertebrae. This means that the vertical height of the back of the seat should be 100-180 mm. The pad should reduce kyphosis of the lumbar region, and hold the spine in as natural a position as possible.
- As far as work seats are concerned, research indicates that a high backrest, slightly concave to the front at its top end, and distinctly convex in the lumbar region, is good both medically and ergonomically. Such a seat profile gives support to the lumbar region when the occupant is leaning forwards yet relaxes the back muscles thoroughly when leaning backwards, because it holds the spine in a natural position.
- Orthopaedics as well as ergonomics recommends frequent or at least occasional changes of position from leaning forward to leaning back and vice versa.

#### Interface design

The position of labels with text or icons is crucial for an unfamiliar user with impaired vision. All too often labels are positioned in a way that they are obscured from the user's view when the controls are being operated. The problem is particularly common when the control panel is at an acute angle to the user's line of sight or at an inappropriate distance. When deciding on the positioning of graphics or labels, the way people who are left handed use the controls should also be considered. Also many people with low vision like to get their face close to the control panel to read



the labels, or use face-mounted or hand-held magnifiers.

It is helpful if the user knows which controls are active at any one time.

Sometimes this can be done by internally illuminating active keys; with complex displays in computer systems, inactive selections from a menu are often displayed with less brightness than the active selections. Blinking indicators should be restricted to situations requiring immediate action by the user; in these cases, they should be supplemented by an auditory signal.

The size and shape of a control knob can make a significant difference for a user with weak grip or for someone with cold hands. The choice of material can also affect the ease with which the knob can be gripped. The shape can help a visually impaired person select the correct knob; the shape can also be used to help the user associate the function with the key.

### 3.7 Anthropometric data of the elderly

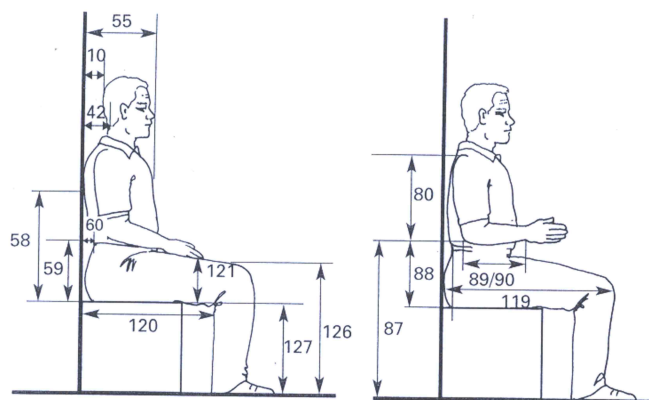


fig 7

Height Average heights of adults in the UK and US steadily decline with age after 20 years of age. Around 40 years of age most people begin to shrink in stature. Women shrink more than men and shrinkage accelerates with age.

This shrinkage occurs in the intervertebral discs of the spine, possibly causing rounding of the back. Some reduction in height may result from shrinkage of lower limbs around the joints.

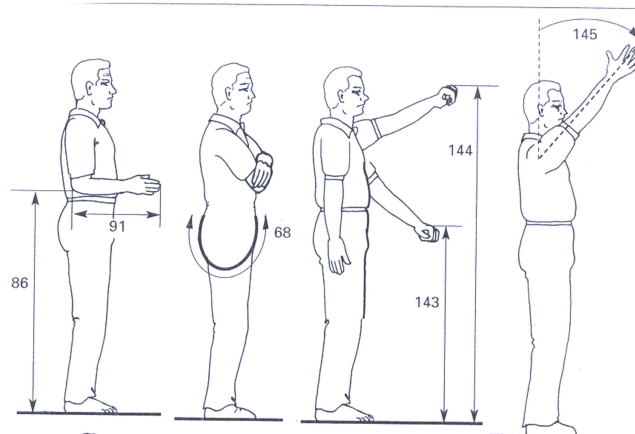


fig 8

### Weight

The average weight of adults increases from ages 20-45. From age 50 onward men's weight declines. From age 60 onward women's weight declines. Until 55 years of age weight increases for heights and there is an increase in hip breadth. Fat is redistributed from subcutaneous areas to deeper positions especially around abdominal organs. Lean body weight decreases with age as muscles waste away. There is a decrease in muscular strength but the mechanical tensile breaking strength of bone, muscle, and connective tissue decreases with age.

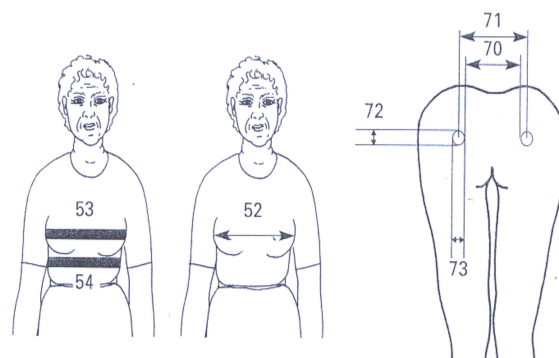


fig 9

### 3.7.1 Suggestions and criteria to be met

- Sitting puts the most pressure on the back. Chairs should either have straight backs or low-back support. If possible, chairs should swivel to avoid twisting at the waist, have arm rests, and adjustable backs.
- While sitting, the knees should be a little higher than the hip, so a low stool or hassock is useful to put the feet on. A small pillow or rolled towel behind the lower back helps relieve pressure while either sitting or driving.
- An upright posture with a ninety-degree hip position is actually unhealthy, from the perspective of the intervertebral discs.

For a number of reasons, the discs experience more pressure and the pressure is more lopsided than while standing. So it's a good idea to sit with the hip joints somewhat straightened. Yes, this resembles a slouch, with your rear end pushing forward in the seat. A supported slouch may be healthy in the long run. Forward-tilt chairs support this posture, but so do chairs with level seats and reclined backrests.

- Even if the hip joints aren't somewhat straightened, sitting in a reclined posture is more healthy than sitting upright.  
This is because reclined sitting puts more of your weight onto the chair's backrest. If the chair backrest holds up more weight, the discs in the lower back hold up less weight.
- All sitters should move around. In addition to helping the muscles relax and recover, this alternately squeezes and unsqueezes the intervertebral discs, which results in better filtration of fluids into and out of the cores of the discs. Discs stay plumper and, in the long run, healthier.

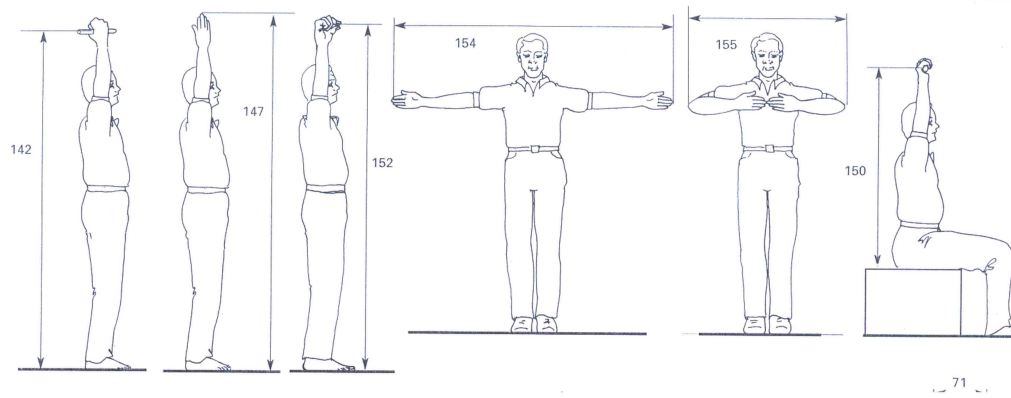
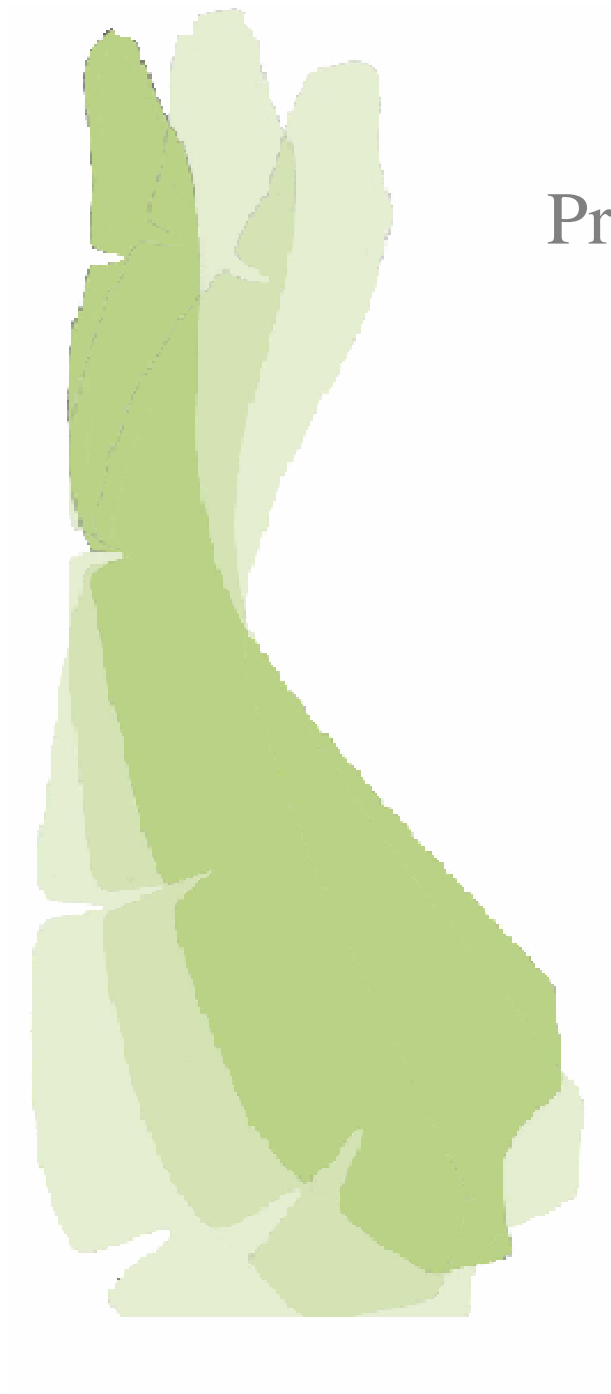


Fig  
10



## Product proposal

## 4.0 Product proposal

The area I chose to explore was that of comfort and the elderly, or lack of comfort. In researching this I discovered just how widespread back pain is and also just how few chairs provide adequate comfort to people suffering from this ailment. Because of this I decided to design a seat aid for the elderly, which would be comfortable and would also prevent further damage to the back and spine. I feel that my final concept fulfils most of the criteria and objectives I set myself. I also feel that as a team we have worked well together and have all come up with new products for older people.

### 4.1 The product

My product proposal is for a portable seat rest, it will incorporate the following;

Promotes correct posture when sitting.

- Incorporates a rocking motion, so the person can change positions easily while sitting.
- Also incorporate a mechanism to push the person up and out of their seat.
- Gel padding to alleviate the problem of pressure sores.

### 4.2 Storyboard of the product in use

Action	Possible solutions	Ergonomic factors
Storage	Hang on hook on a wall.	Height considerations
	Fold up and stow away	Bending over.
Picking up	Handle.	Handgrip sizes.
	Two side handles	Ergonomic grips.
Carrying	Handles	Weight restrictions.
Placing on seat	Seat adjustments	Form.
Sitting down	Shape conforming	Ergonomic form of

		buttocks region
Sitting	Relieve constant pressure	Rocking motion
Getting up	Ease person out of seat	Standing motion
Picking up	Handle	Bending over
Maintenance	Wipe able	
Disassembly	Plastic comes apart Gel packs stay intact	Force and leverage.

### 4.3 Ergonomics related to my product in use

- Height considerations.
  - Standing height decreases as a result of greater slouch and compression of fibrous discs between bony vertebrae.
  - Because of the increase in average size from decade to decade the elderly are shorter than the rest of the population.
  - Loss of muscle flexibility and strength.
- Bending over.
  - Dizziness and imbalance result from bending to reach areas too low.
  - Increased fear of falling.

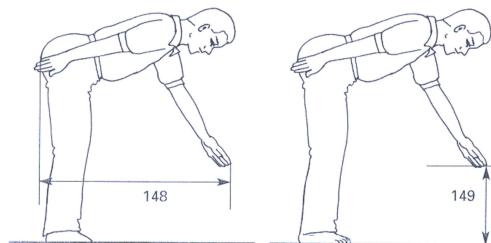


fig 11

- Handgrip sizes.
  - The grip should neither be too big or too small.
  - It should be easy to access and to release grip.
- Ergonomic grips.
  - Cushioned grips.
  - Textured grips

fig 12



- Weight restrictions.
  - The product should weigh less than 1 lb.
  - It should be able to hold up to 300 lbs
- Form.
  - The product should be smooth, with soft edges.
  - It should fit into a number of different chairs adapting each time to suit the chair.
- Ergonomic form of buttocks region.
  - The product should fit to a number of different size buttocks, so it should be expandable and contractible.
  - It should curve to accommodate the buttocks and should have padding.
  - It should reduce pressure on the coccyx (tailbone).
- Rocking motion.
  - The product should incorporate a rocking motion to enable the user to change postures quickly and easily.
  - The rocking motion will also promote the change of posture, which will minimise problems related to the spine and pressure sores.
- Standing motion.
  - The product will aid the user in standing up as this can start to become a problem, as a person gets older.
  - It will incorporate a gentle spring motion to ease the user up out of the seat; this will be triggered when the person either sits forward a certain amount or else by a release catch.
- Force and leverage.



- The product must be able to be disassembled with minimum force being applied.
- The gel packs must stay intact during the disassembly process.

#### 4.4 Existing products

In doing my research I found that of the few products on the market used as seat aids, very few are ergonomic. They tended to deal with just one problem while totally ignoring others. None of them dealt with the issue of promoting changing postures, which I feel is vital in relieving a lot of problems associated with sitting.

They were stiff, some hard and uncomfortable. They were neither inviting to sit on or in any way stylish. One of the worst I came across was the wedge, although in theory this idea is quite good, it does not work to its full potential. I feel that a few minor adjustments to this would make an incredible difference to the comfort level experienced while using this product.



fig 13



## Concept generation and development

## 5.0 Concept generation and development

### 5.1 Concept research

The area of research I chose to focus on was back pain and all associated problems. My research led me in a number of different directions. During my ergonomics research I became aware of the problems associated with seating and decided to focus on this area. As a result of my research findings I decided to design a seat aid. This seat aid will promote proper posture and promote frequent movement. It will relieve pressure and therefore help in eliminating lower back pain and pressure sores. It will be a portable seat aid, which can be used on a number of different seats, i.e. car seats, office chairs, kitchen chairs.

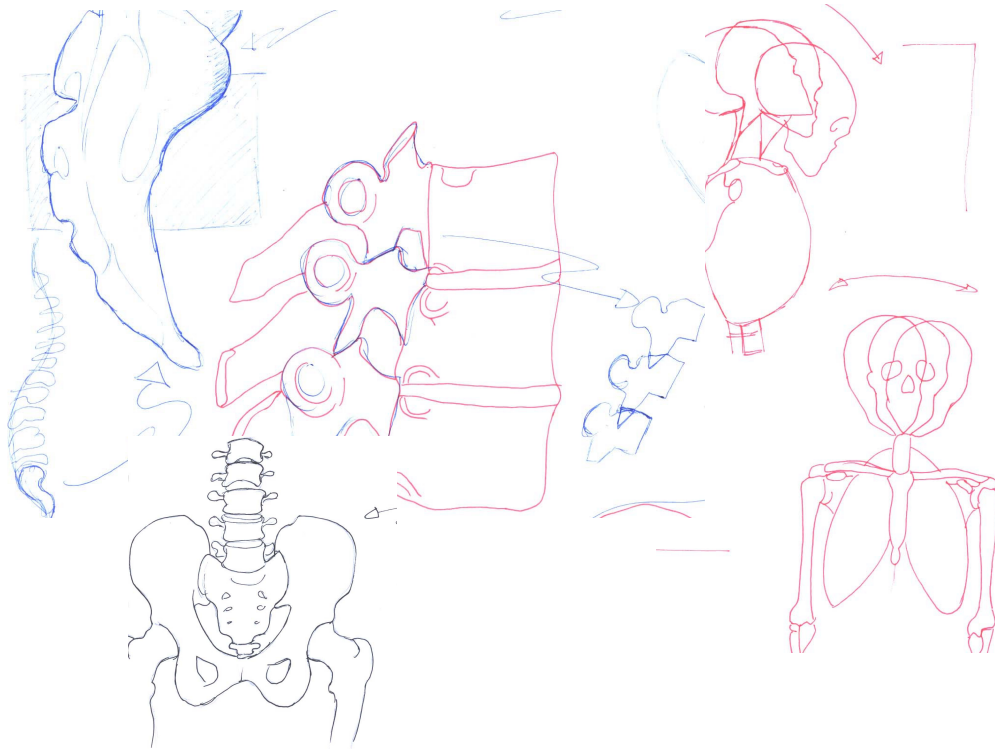


Fig 14

## 5.2 Areas of inspiration

### The human body

I felt that I could learn a lot about lower back pain by looking at the internal mechanisms of our bodies. I also felt that the body and all its complex structures would be interesting to apply to my design.



### The Rocking chair

As I had decided to design a seat aid I researched chairs. I found rocking chairs to be particularly interesting, and thought it would be an appealing feature to incorporate into the product. As the rocking motion itself is soothing and reminiscent of a cradle. I also discovered that frequent movement aided the relief and prevention of lower back pain.



Fig 16

### 5.3 Colours and styles

Colours can evoke strong feelings in people; the colour of a product can be just as important as its form. Because of this I researched colour therapy and symbolism. The colour I chose to apply to my product is a lime green. Lime green was already one of our brand colours and I wanted my product to have a strong brand identity. I also found green to be a fresh natural colour that was soothing and non-threatening.



Fig 17

I researched styles and forms in magazines, and existing products. I wanted my design to be up to date so I looked at fashion but also appealing to the elderly so I researched some magazines and also television shows aimed at the elderly. The form I based my design on was inspired by the bones of the human body but the subtle curves and soft edges were also inspired by existing designs I wanted to emulate.

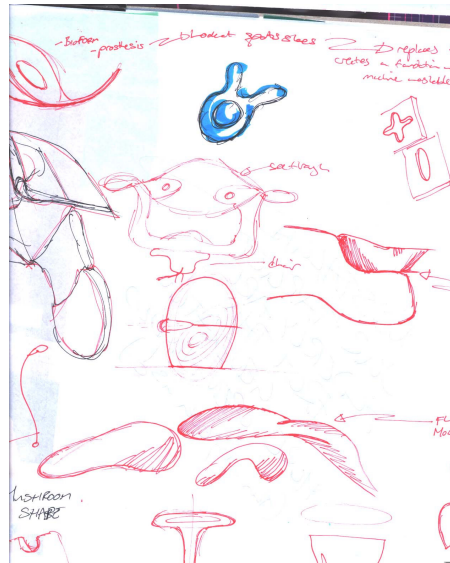


Fig 18

## 5.4 Final concepts

In most cases the chair must adequately support the weight of the sitter at such a height that the legs hang down and the feet touch the floor. In most conventional sitting positions, the weight of the head and torso is carried down to the bones of the hip and pelvis. The timeless problems associated with this physical relationship is that however much a chair seat may be softened, the pressure of the bone will eventually be felt in the flesh of the buttocks as uncomfortable.

Ultimately this leads to the user having to change position, something which is done on average every ten to fifteen minutes. The more a chair is formed to give an ideal static support and posture to the average human frame, the more it guarantees discomfort and, therefore physiological stress for people with non-standard anatomies or those who do not wish to assume that particular position or posture.

It is probably safe to say therefore, that while the facility for correct lumbar support is important, especially in office seating, it is not as crucial as the chair allowing the user

to move their legs freely and to make adjustments of posture. For healthier sitting, a chair should thus facilitate freedom of movement and encourage a variety of postures while providing flexible continuous support.

### Criteria

- To design a chair that conforms to the person, not the other way around.
- The chair aid should change shape with the persons back as his or her posture changes.
- For healthier sitting, a chair should facilitate freedom of movement and encourage a variety of postures while providing flexible continuous support.
- Should relieve the problems associated with sitting, such as lower back pain and pressure sores.
- Team styling and chosen colour schemes should be considered.

### Concept 1

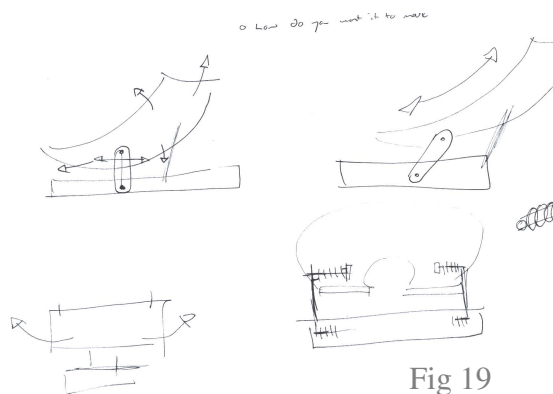


Fig 19

For one of my concepts I looked into incorporating a sliding mechanism. This would enable the user to slide forward and back, shifting their weight frequently.

### Concept 2

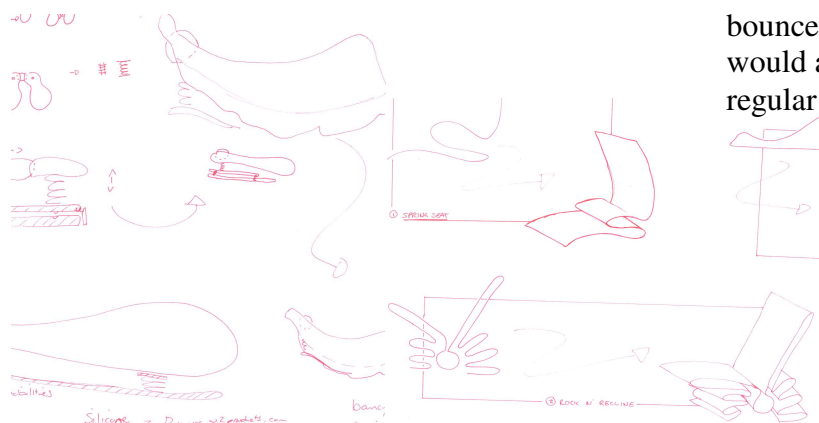


Fig 20

I then looked at springs and bounce movements which would also promote more regular weight distribution.



### Concept 3

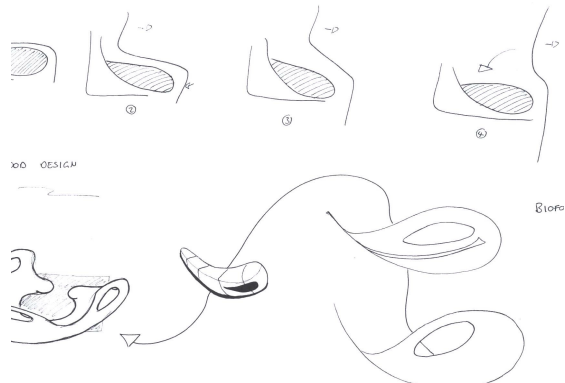


Fig 21

I wanted my product to incorporate a rocking motion so I played around with this idea. I felt that this was the most user friendly idea as the mechanisms in the other concepts could be distracting and movement was too frequent. I also wanted my product to be more organic than mechanical.

### 5.5 Chosen concept

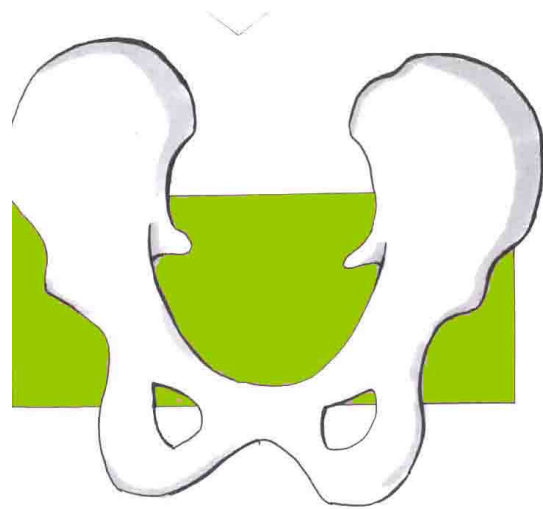
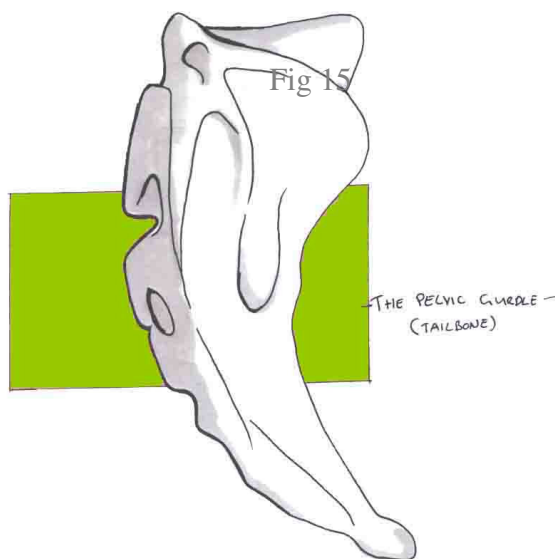


Fig 22

I chose to base my design on the bones of the lumbar region, as these are involved in the sitting action. I combined both the coccyx bone and the pelvic girdle.



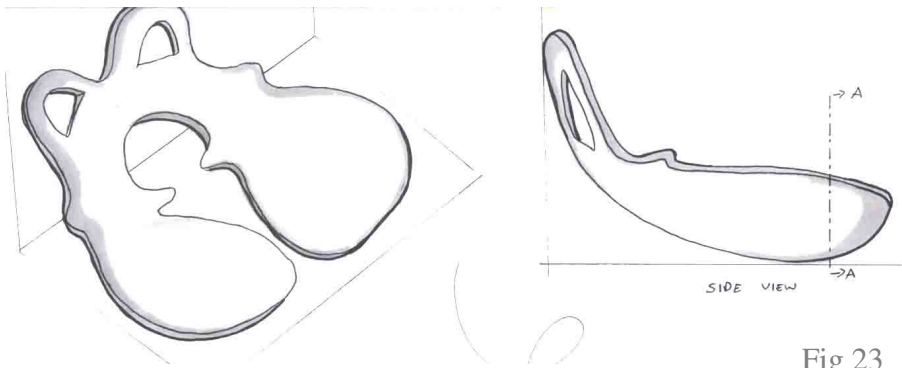


Fig 23

Both of these forms adapted well to the task. The coccyx became the base of the product and proved to be the perfect form for the rocking motion I had been trying to incorporate. While the pelvic girdle was adapted to become the seating and padding area.

### 5.5.1 Developments

In the development stage the base of the product was adjusted so as to have uniform grips. These grips also helped with the flexibility of the product. The shape was also flattened as the seat aid needed to be slimmer. The shape of the seat remained basically the same with minor adjustments to make the product simpler. The seat area itself became a padded area to relieve pressure points.



Fig 24

### 5.5.2 Features and functions

The core or skeleton of the product is flexible, this allows the product to expand to adapt to different sized users. This also allows the user to change weight from one leg to another. The grips on the base of the product enable it to grip different surfaced material which can be found on different chairs. The rocking motion encourages the user to change position and posture frequently. Pressure points are reduced due to the increased movement, and thus circulation and frequent shift in weight. A main pressure point is eliminated as the tail bone is suspended between the seat cushions. The seat aid is portable and lightweight.

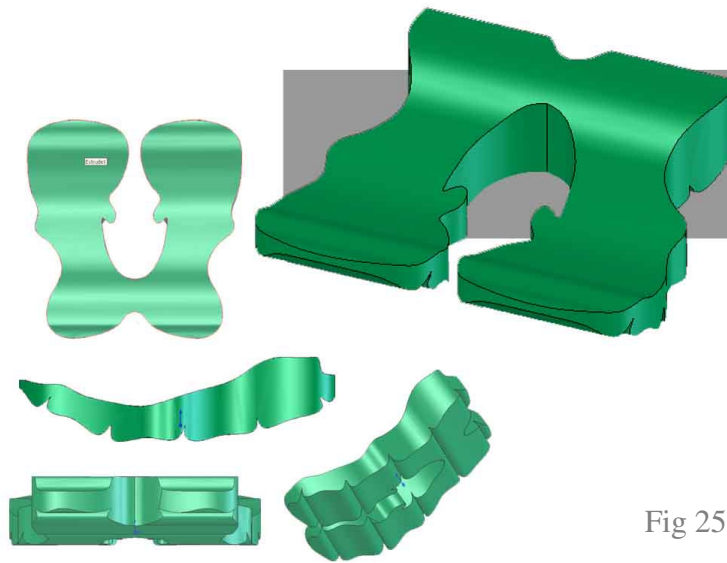


Fig 25

### 5.5.3 How it works

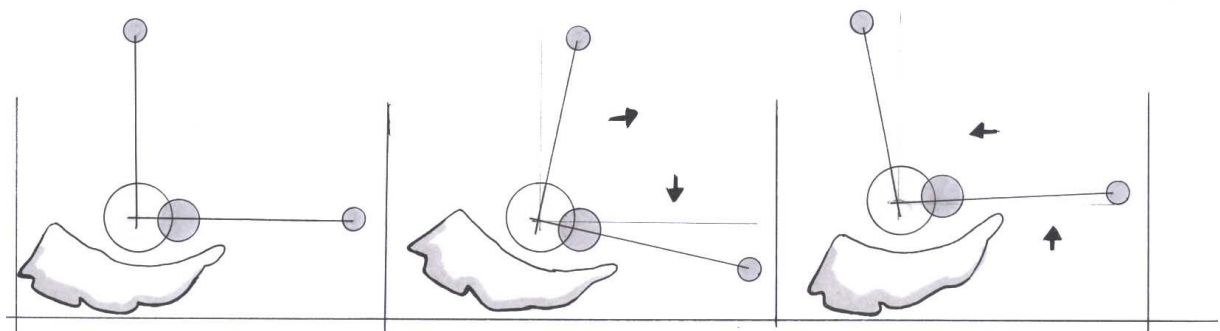


Fig 26

The seat aid is placed on a flat surfaced seat. The user sits down and can then rock forward or back in order to find their preferred position. The portable posture can quickly and easily change position to suit the user.

#### 5.5.4 Final concept

This seat aid will promote proper posture and promote frequent movement. It will relieve pressure and there for help in eliminating lower pack pain and pressure sores. It will be a portable seat aid, which can be used on a number of different seats, i.e. car seats, office chairs, kitchen chairs.



#### 5.6 Product market

Fig 27

##### Positioning

Primarily it will be displayed as a stand alone product and will be sold in stores such as Argos, Wall Mart and the Shopping Channel.

##### Branding

The product will have a strong brand identity and will tie in with the other products of the group. The styling will play a large part in this being achieved.

##### Pricing

My product will be positioned in the mid range price bracket. I want it to be affordable to all but also with some prestige attached to its price.

##### Packaging

The packaging will incorporate the team branding and logo.

##### Promotion

My product will be sold primarily to the elderly through advertisements in magazines such as Irelands own. Advertisements on television channels such as TCM and UK GOLD, will feature the product as not only revolutionary but also stylish.

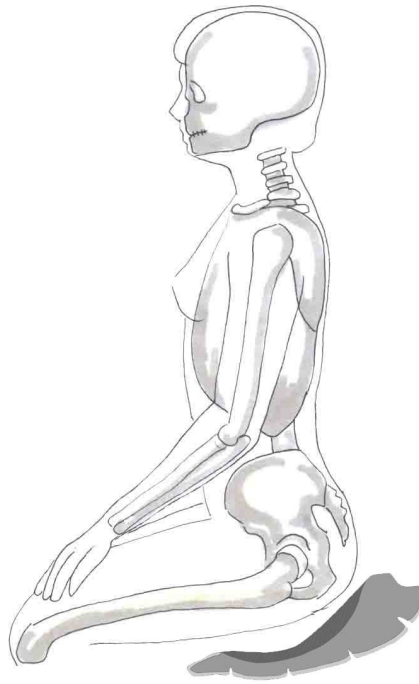
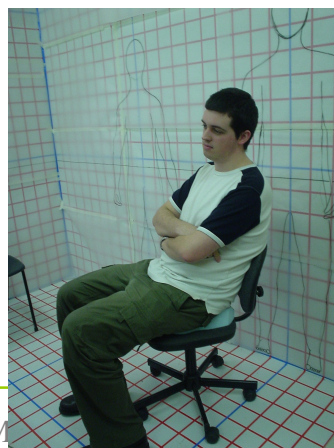


Fig 28

My final concept for a portable seat aid will both relieve lower back pain and be comfortable to sit on. It is a stylish functional product which I feel will appeal to the elderly. It is a very ergonomic product which adapts to different body sizes without making an issue or drawing attention to this feature. The rocking motion is soothing and functional, functional as it encourages the user to change position and posture frequently and soothing as the rocking motion is very relaxing and evokes memories of good times in the users unconscious. The opaque lime green colour is relaxing and fresh at the same time. I feel that my concept has fulfilled any brief and criteria I have set

feel

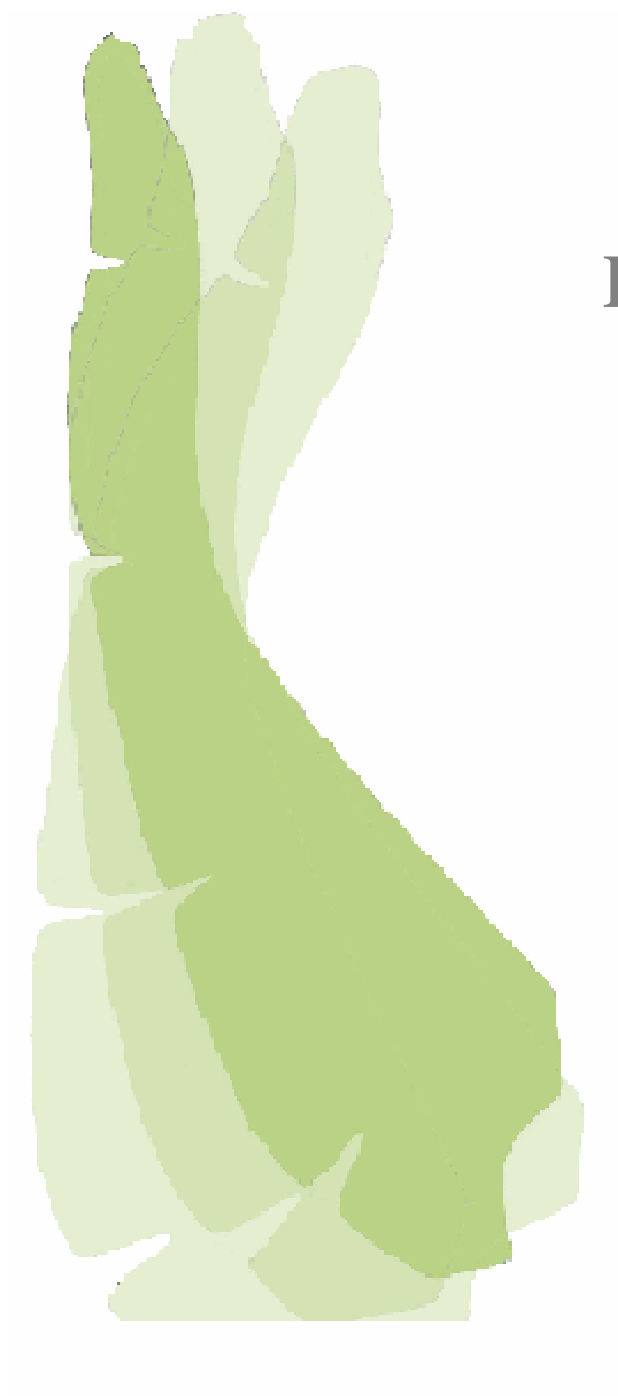


Eva M

myself, I also  
that it is a  
market worthy  
product.

Fig 29

Fig 30



## Branding

## 6.0 Branding

### Branding

We wanted to choose an existing company and work our designs around their brand. Because we have found in our research that most products designed for the elderly are bland and mainly just functional products with little or no aesthetics, we choose the Swiss company swatch. We felt that we could use this company's brand identity and fresh design ethos and apply it to our project. We have decided that we will create a sub design branch focused towards the elderly. We have named our design team, WISE DESIGN.

### Logo

#### Concepts

WiSE DESiGN

W/SE DES/GN



Fig 31

We chose the third concept as it was a clean yet stylish logo; it incorporates a leaf which symbolises the tree of knowledge.

### Philosophy

'Our products are older and wiser', you control the products they don't control you.  
(One button one function)

### Colour scheme

We didn't want our products to be funky and new, but we did want them to be fresh. Most products for the elderly are beige, white and boring. Our colour scheme was chosen to freshen up the products but without being too bright. We have chosen a lime green, a soft grey/white and silver. We feel that these colours compliment each other without jumping out at the consumer.

**Texture**

We want to promote the idea of friendly products; we want to incorporate the feeling of quality into our products. We want them to be soft (either to touch or the look would imply softness)

**Surface detailing**

- Ribbing.
- Finger indents.
- One button one function.
- Simple looking and simple to use, (so simple its clever).
- Highlight buttons rather than having them too big. (Patronising).
- Incorporate LEDs that light up buttons.
- Transparency maybe with the lime colour.

**Styling and shape**

- Subtle curves, soft edges.
- Not too dynamic and in your face.
- Ergonomic, bigger for easy handling.
- Clean lines, gives illusion of quality.
- Minimise split lines.
- Hide components, (don't show how the product works, as it might distract and confuse the user)



Fig 32





## **Manufacture and assembly**

## 7.0 Manufacture and assembly

### 7.1 Manufacturing materials and methods

The product is made up of three different materials. The casing is made from high density polyurethane, the padding from techno gel and the base from closed cell polyethylene foam. All of the parts are to be injection moulded.



#### High density polyethylene

High density polyethylene was chosen as the outer casing because it is a hard, tough and resilient polymer which will stand up to wear and tear. Polyethylene is also quite flexible with a bit of give which is needed for this product, to aid the movement of the legs while retaining support. It is also quite a cheap material to manufacture and lends itself quite well to injection moulding.

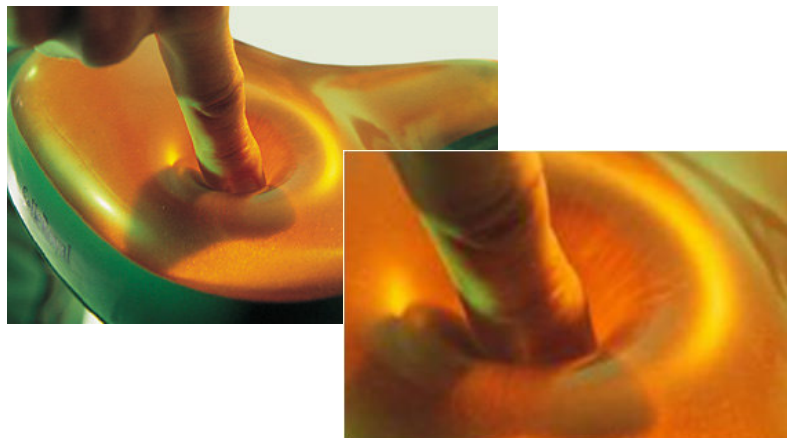


Fig 33

#### Techno gel

Techno gel is a polyurethane matrix product, it has been used in the bicycle industry for years as a revolutionary new padding used in saddles. The techno gel padding reduces peak pressure on your sit bones by up to 40%. Techno Gel is up to 800% expandable and offers a correspondingly high level of comfort. The new polymer gel

evidences a high level of heat conductivity. It absorbs body heat slowly and then quickly dissipates it again. This avoids "overheating" of the skin. Even after prolonged exposure to high pressure, Techno Gel returns to its original shape with virtually no changes. Techno gel is an advanced self-adhesive soft gel, durable, elastic and air permeable. It adapts smoothly to the contours of the skin, alleviates pain by providing shock absorption and cushioning. The gel is extremely well tolerated on the skin and can be repeatedly washed whilst retaining its adhesive properties. The special chemical structure, consisting of long polymer threads with only a few links, makes Techno Gel especially strong and highly flexible at the same time. Resolute avoidance of softeners permits unlimited high durability

### **Closed cell polyethylene foam, EVA**

This grade is a firm foam, but with a softer, rubbery feel. When pressing your fingers into it, it squishes down a little but comes right back into place. This will aid the product gripping the seat material and allow the product to be used on a number of different surfaces, from padded seat cushions to plastic chairs. It will adapt to the different seat shapes and will return to its original shape once removed. EVA also lends itself quite well to being injection moulded.

### **Injection moulding**

All parts will be injection moulded. Injection moulding gives a high quality finish with great accuracy, it is a versatile method of manufacture and is easily automated and gives

high production rates.



## **7.2 Operating environment specifications and performance specifications**

The product has little operating specifications, it is a simple product which has been designed to promote better posture and eliminate existing problems associated with seating. Thus, the user does not need to do anything other than sit on it. This can be viewed as a positive thing as it is primarily aimed at the older market that has less time for gimmicky products.

## **7.3 Maintenance requirements**

- The product should be kept out of direct sunlight, as this may lead to discolouration.
- The product may be wiped with a damp cloth to clean it.

## **7.4 Conformance requirements and safety requirements**

The product has been designed in accordance with the European community safety standards, CE.

It uses non hazardous materials.

There are no small parts in product which may become dislodged or swallowed.

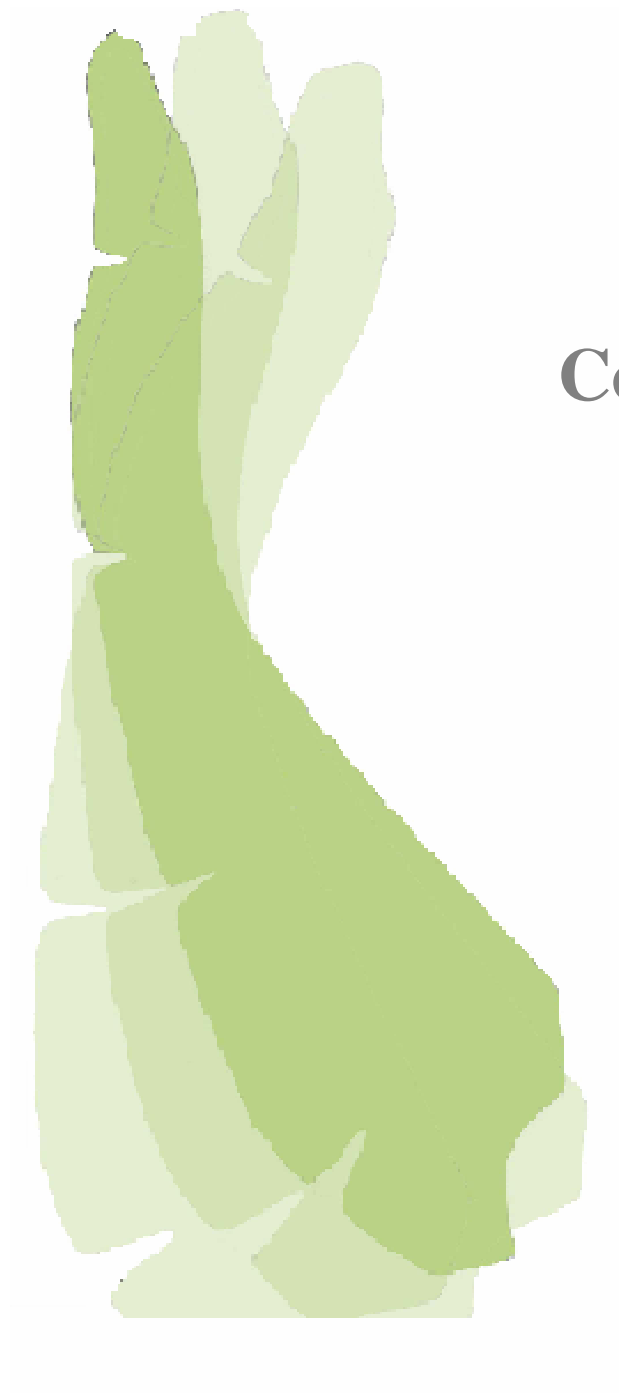
## **7.5 Disposal recycling requirements**



The product is easily dismantled for recycling.

The high density polyethylene is easily identified by this marking and can be placed in the domestic recycling bin. Both the techno gel and EVA materials can be returned to the company for reuse and for safe disposal.

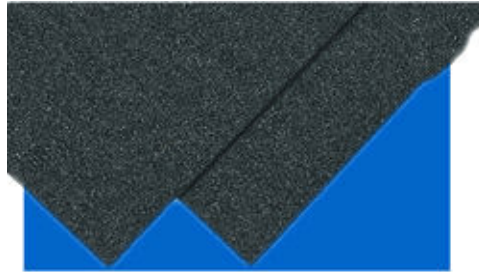
The impending laws about recycling, and the availability of scrap polyurethane foam that can be processed at reasonable costs, are catching the interest of moulded foam manufacturers regarding the possibility to use recycled foam in the production of new PU foam parts. Legislation which is particularly relevant to plastics is the 1994 European Union Directive on Packaging and Packaging Waste 94/62/EC (the Packaging Directive), which aimed to establish producer responsibility for packaging waste. The directive was implemented in the UK through the Producer Responsibility Obligations (Packaging Waste) Regulations 1997 and the Packaging (Essential Requirements) Regulations 1998. The former sets targets for the recovery and recycling of packaging wastes, including plastics packaging waste. These targets are currently being revised by the EU.



## Costing

## 8.0 Costing

### Closed cell polyethylene foam, EVA



- \* are inert and lightweight
- \* are tough, flexible and resilient
- \* are highly energy absorbent
- \* are easily fabricated using well known techniques
- \* are easy to thermoform using standard vacuum forming or heat impression molding techniques
- \* have a very wide operating temperature range
- \* exhibit excellent chemical and water resistance
- \* do not cause staining of paint finishes
- \* do not corrode metal parts
- \* exhibit good U.V. Stability

The superiority of these products, compared with polyethylene foams made by other technologies, stems directly from the use of this high pressure gas technology.

This produces pure, chemically inert foam without blowing agent residues and with a uniform cell structure and regular cell walls. The process comprises three main stages

#### **Product Advantages**

The unique manufacturing process results in a range of unique properties which, in turn, can help to differentiate the finished product from those made using other foams

Some examples of these properties translating into applications are discussed below;

### **A Very Pure Product**

Because there is no chemical blowing agent used, the resultant foam product is very pure. This gives rise to the following

<b>Biologically inert</b>	<b>important for health care applications</b>
<b>Very low fogging</b>	<b>important in optic applications</b>
<b>Does not smell</b>	<b>Helpful for all production</b>
<b>Ammonia free</b>	<b>Some packaged products are sensitive to ammonia contamination.</b>
	<b>Our foam products are ammonia free</b>

### **Very Regular Cell Structure With Minimal Density Variation**

This means that designers do not need to over specify in order to take account of density variations within the sheet. this therefore implies;

<b>Lighter foam</b>	<b>This is valued in cushion packaging where weight savings can be vital.</b>
<b>Predictable properties</b>	<b>Important when designing molded components or packaging sensitive products.</b>
<b>Stronger foam</b>	<b>Density for density our foams are tougher and stronger than other foams. This is appreciated in most applications where performance is part of the specifications.</b>

Specification:

<u>Properties</u>	<u>Method</u>	<u>Units</u>	<u>Typical Value</u>	
			<u>EV45CN</u>	<u>LD50CN</u>
Density	ASTM D3575-84	lbs / cu ft	2.8 nominal	3.1 nominal
Volume Resistivity	ASTM D991-89	ohms-cm	10E3	10E3



Contact Corrosivity	Fed Std 101C Method 3005		Pass	Pass
Operating Temperature	Internal	Degrees F	-95 -- +150	-95 -- +200
Tear Strength	ASTM D3575-84	lbs / in	17	16
Tensile Strength	ASTM D33575-84	psi	80	85
Elongation at break		%	165	50
Water Absorption	ASTM 3575-84	lbs / sq ft	< 0.02	< 0.02

## High Density Polyethylene

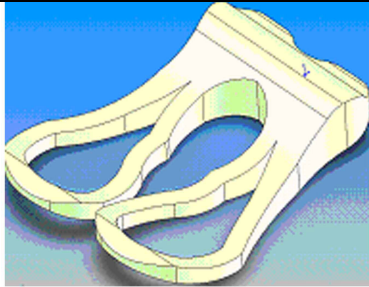
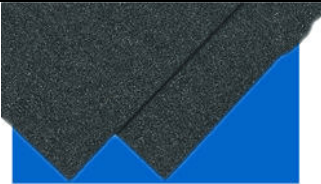
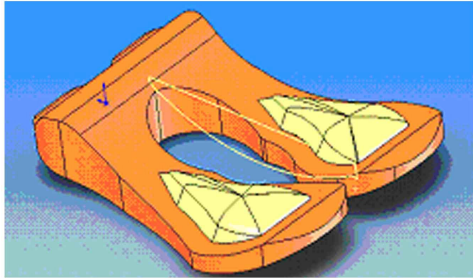
HDPE is the high density version of PE plastic. It is harder, stronger and a little heavier than LDPE, but less ductile. Dishwasher safe.

HDPE is lighter than water, and can be moulded, machined, and joined together using welding (difficult to glue).

The appearance is wax-like, lustreless and opaque. The use of UV-stabilizers (carbon black) improves its weather resistance but turns it black. Some types can be used in contact with food.

## 8.0 Costing

### 8.1 Component listing

Component listing		Bill of materials	
Base part	1	High Density Polyethylene	
Top surface part	2	Closed cell polyethylene foam, EVA	
Padding	3	Techno Gel	

## **8.2 Final product target costs**

### **8.2.1 Raw Materials**

#### **1. High Density Polyethylene**

Size:

Density 0.95 p/mg

Volume 1733941.34 cubic millimetres

Mass 1733.94 grams

Weight 1.5 kg

Quantities 1

Cost €3.30

#### **2. Closed cell polyethylene foam, EVA**

Size:

Density 0.4 p/mg

Volume 439632.00 cubic millimetres

Mass 439.63 grams

Weight .5 kg

Quantities 1

Cost €0.75

#### **3. Techno Gel**

Size:

Density 0.2 p/mg

Volume 178433.60 cubic millimetres

Mass 178.43 grams

Weight .25kg

Quantities 2

Cost €1.20

### **8.2.2 Processing cost**

€ 60 per hour covers the cost of the operator and production cost of injection moulding machine

Component 1 takes 1.2 min to product - €1.20

Component 2 takes 1 min to produce - €1.00

Component 3 takes 1 min to produce - €1.00

### **8.2.3 Tooling cost**

I am amortising the cost of the tooling over 3 years and each year I am going to manufacture 60,000. Over 3 years that's 180,000 so the tooling cost per component is

1. € 0.28

2. € 0.55

3. € 0.39

### **8.2.4 Estimating the cost of assembly**

It takes 40 seconds to assembly the final product.

It will be assembled in Ireland, where the hourly wage is €20 per hour, (this covers holiday pay, PRSI, insurance, and the wage.)

Therefore it works out at €0.50 per unit assembled.

### **8.2.5 Estimating overheads costs**

40 % of the overall figure of total components is €1.33

### 8.2.6 Costing Table

component	raw materials	processing costs	assembly costs	overheads	total variables	tooling costs	total fixed costs	total costs
1. base	3.3	1.2	0.5	1.33	6.33	0.28	0.28	6.61
2. top	0.75	1	0.5	1.33	3.58	0.55	0.55	4.13
3. padding	1.2	1	0.5	1.33	4.03	0.39	0.39	4.42
column total	5.25	3.2	1.5	3.98	13.93	1.22	1.22	15.15
total cost								15.15

**Total cost per unit is €15.15**

### 8.3 sales forecast