

Innovation in a bed assembly unit design to reduce the symptoms of GERD and Snoring during sleep

Associ. Prof. Dr. Sarah Fathy Ahmed Fahmy

Associate professor of Interior design and furniture - Interior design and furniture department-Faculty of Applied Arts – Damietta University- Egypt.

sarahfathyfahmy@gmail.com

Dr. Haitham Ibrahim Elhadidy

Lecturer of Industrial design – Industrial Design department - Faculty of Applied Arts – Damietta University- Egypt.

dr.haithamelhadidy@gmail.com

Abstract:

Stomach acid reflux disease (GERD) and esophagus reflux are classified as widespread diseases in Egypt and the Arab world as some of the most widespread gastrointestinal tract disorders. These disorders result in symptoms such as disturbing voices during sleep periods (snoring). Studies show that both men and women of all ages experience an increase in cases of esophageal reflux, whether temporary, intermittent, or permanent reflux.

It has been shown that the middle-aged group is the most vulnerable to the disease, and the cost of treatment is estimated to about \$ 5.4 billion annually, which leads to negative repercussions on the national economies. (ElMestekawy: 2019)

The bed in Egypt and the Arab world is characterized by perseverance and incapability to adjust its level, (ElMestekawy: 2014), Physicians advise patients to raise the back of the bed to alleviate the symptoms of esophageal reflux during sleep so as not to cause suffocation to the sleeping person, which in turn leads to the elimination of snoring sounds during sleep, and when raising the sleeping person's back with cushions due to the stability of the bed position at home, this resulted in an increased feeling of fatigue after sleeping for sufficient periods of time for rest, causing back pain and neck tension.

Hence, the designer had to step in to solve part of the problem, which is adjusting the bed horizontal axis to get an ideal sleeping position for patients so that the back of the bed can be tilted and moved according to the weight and size of the sleeping person, such as medical beds in hospitals and medical clinics, but in a different way and easier to use in order to reduce pains suffered by patients.

Key words.

Bed - Design - Esophageal reflux - Snoring - Assembly connections.

ملخص البحث

يصنف مرض ارتجاع حامض المعدة إلى المريء (إرتجاع المريء GERD) والإرتجاع البلعومي الحنجري (esophagus reflux) من الأمراض واسعة الإنتشار بمصر والوطن العربي كأحد الأمراض التي تعيشها هذه الدول، وقد نتج عن هذه الأمراض بعض الأعراض مثل توتر الرقبة وتعالى الأصوات المزعجة أثناء فترات النوم (الشخير Snoring)، ولقد أظهرت الدراسات المختلفة بأن كلاً من الرجال والنساء من جميع الأعمار قد واجهوا زيادة في حالات إرتجاع المريء سواء كان ارتجاع مؤقت أو متقطع أو ارتجاع بصورة دائمة.

ولقد تبين أن فئة الأشخاص في منتصف العمر هي الأكثر عرضة لهذا المرض، وتقدر تكلفة العلاج له حوالي 5.4 بلايين دولار سنويا على مستوى العالم مما يؤدي إلى انعكاسات سلبية على الإقتصادات الوطنية لتلك الدول. (المستكاوى: 2019). وينصح الأطباء بمصر مرضاهم برفع سطح السرير حتى يخفف من حدة أعراض مرض الارتجاع المريئي أثناء فترات النوم حتى لا يتسبب بالاختناق للشخص النائم، (المستكاوى: 2014)، والذي يؤدي بدوره إلى القضاء على أصوات الشخير أثناء النوم، ويتم ذلك بوضع الوسادات المختلفة أسفل الرقبة وأسفل ظهر الشخص النائم نظرا لثبات وضعية السرير بالمنازل والذي ينتج عنه آلام توتر الرقبة والعمود الفقري وزيادة الشعور بالإرهاق بعد النوم لفترات كافية للراحة. وهنا كان لابد من تدخل المصمم الداخلى والمصمم الصناعى لحل جزء من المشكلة وهي تعديل محور السرير للحصول على وضعية نوم مثالية للمرضى بحيث يمكن إمالة ظهر(سطح)السرير ككل وتحريكه طبقا لوزن وحجم الشخص النائم، وكان لزاما على المصممين استحداث تصميمات لوصلات تجميع والتي بدورها تعمل على تحريك راحة السرير وجعله متحرك مثله مثل الأسرة الطبية بالمستشفيات والعيادات الطبية ولكن بشكل مختلف وأكثر سهولة فى الإستخدام، وذلك لتخفيف العبئ عن المرضى بشكل عام.

الكلمات المفتاحية:

التصميم – السرير – ارتجاع المريء – الشخير – وصلات التجميع.

Research problem:

Many people in Arab world suffer from the symptoms of esophageal reflux disease and esophagus reflux and from disturbing voices during sleep periods (snoring) as one of the diseases of luxury for the current age which requires adjusting the position of the body axis during periods of sleep on the bed where doctors always advise to raise the back during sleep periods so that stomach acid don't reflux into the esophagus.

There are some symptoms that are associated with lifting the back, such as back pain, neck tension or feeling tired after sleep for sufficient periods of time, and therefore the designer creates new bed designs to achieve different inclination angles that help alleviate the symptoms of reflux severity.

The problem can be formulated in the following question: Can the symptoms of esophageal reflux and snoring during sleep be reduced by adjusting sleep positions and designing a bed with new specifications?

Research objective:

The research aims to design a new bed that can be inclined to different angles to help reduce symptoms of esophageal reflux, as well as eliminating annoying snoring sounds during sleep.

The research also aims to provide new assembly links to adjust the angles of fixed beds available in Egyptian homes, which helps to reduce treatment costs and decrease the need to buying new beds.

Assumption of research:

Research assumes that by changing the position of the angles of the axis of the body as a whole during sleep periods, symptoms of esophageal reflux disease can be reduced, eliminating the sounds of snoring caused during sleep, as well as reducing the feeling of fatigue after sleeping for extended periods of time.

Preface:

One of the most common gastrointestinal disorders in Egypt and the Arab region is stomach acid reflux disease, which is also known as reflux disease. Where the vast majority of people are subjected to temporary reflux at least once a month, and often this occurs after a large lunch or a spicy meal. During the recent period, cases of esophageal reflux increased by 30%, and cases of acute symptoms of the disease have increased by 24%, while cases of symptomatic attack increased once a week to approximately 47%. Common signs and symptoms of GERD include: a burning sensation in chest (heartburn), usually after eating, which might be worse at night, chest pain, difficulty swallowing, regurgitation of food or sour liquid, sensation of a lump in your throat.

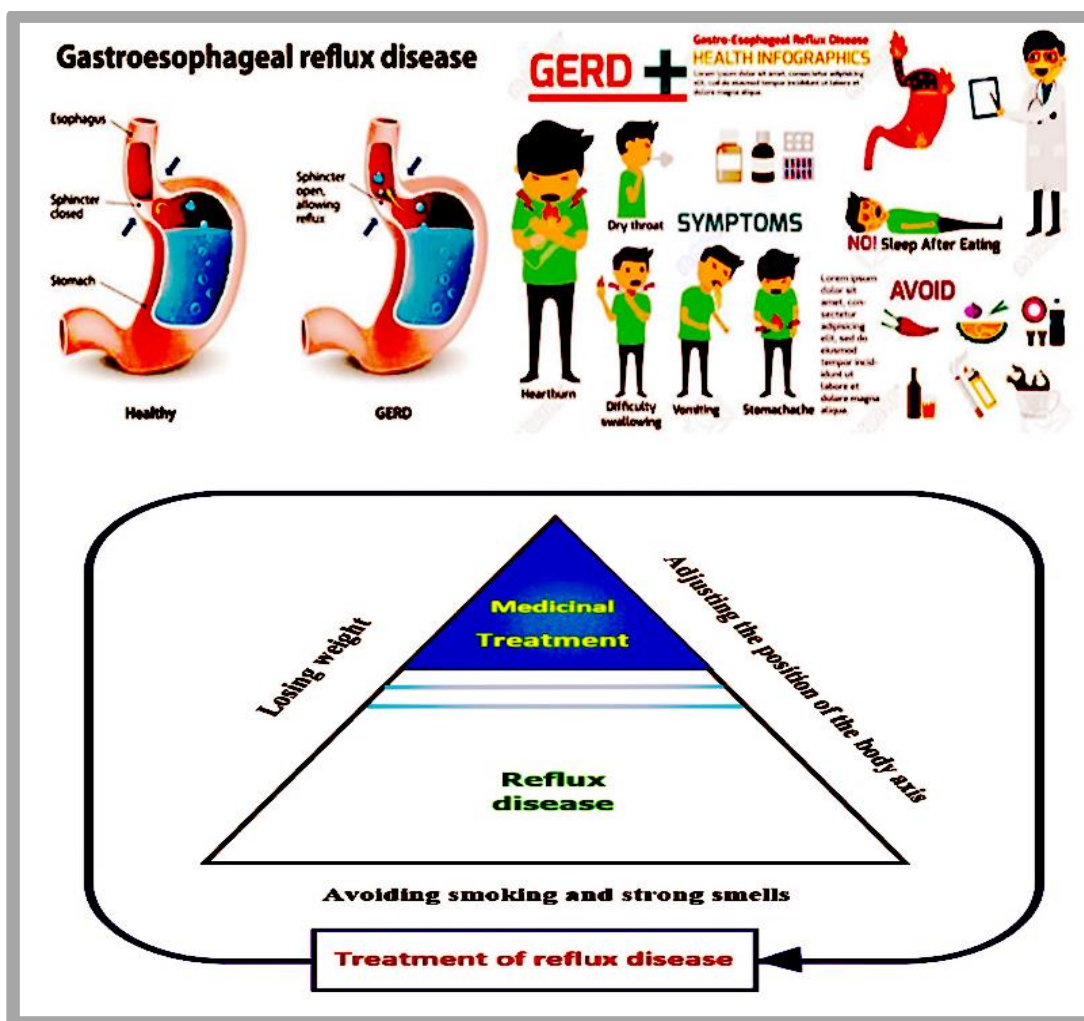


Figure no. (1) Shows reflux disease and the mechanism of treatment. Source: by researchers

Introduction.

Esophageal reflux disease and snoring have begun to spread rapidly and broadly in the world, especially in the Arab world, especially in the last twenty years as one of the welfare diseases experienced by these countries in the past two decades, just as diabetes, obesity, heart disease and hypertension have been. This disorder was rare and appeared only in elderly people, but nowadays it is common in children, youth and the elderly. Health professionals are deeply concerned because of the impact on the health of the individual and society.

The esophagus is in the form of a long muscle tube extending from the pharynx to the opening of the stomach inside the rib cage, and the upper and lower ends are controlled by two muscle rings (two valves) that allow food to pass from the pharynx to the stomach but prevent it from returning from the stomach to the esophagus and then to the pharynx. Obesity causes these muscles to become weak and relaxed that they allow reflux. (Fahim: 1996)

And this tube (esophagus) is covered with an impervious epithelial membrane that is affected only by a little reflux but in the case of continued reflux and intensity this mucous membrane loses its immunity and resistance, and from there the problem begins in the case of weakness of the muscle that connects the stomach and esophagus, the reflux is esophagus, and pharyngeal (Starovoytova, 2018).

And when the valve does not play its role properly, it prevents the gastric juice from going out from it up to the esophagus, and here the problem occurs where the acid causes inflammation of the esophageal wall, and inflammation may develop into severe inflammation, which may result in more serious complications, and on the other hand, eating more The excretion of acids in the stomach makes reflux more harmful to humans, causing acidity, burning and pain in the esophagus.

Symptoms are always more severe when relaxing in the normal posture to sleep where suffocation occurs during sleep due to the horizontal posture of sleep, as illustrated in figure no.2.

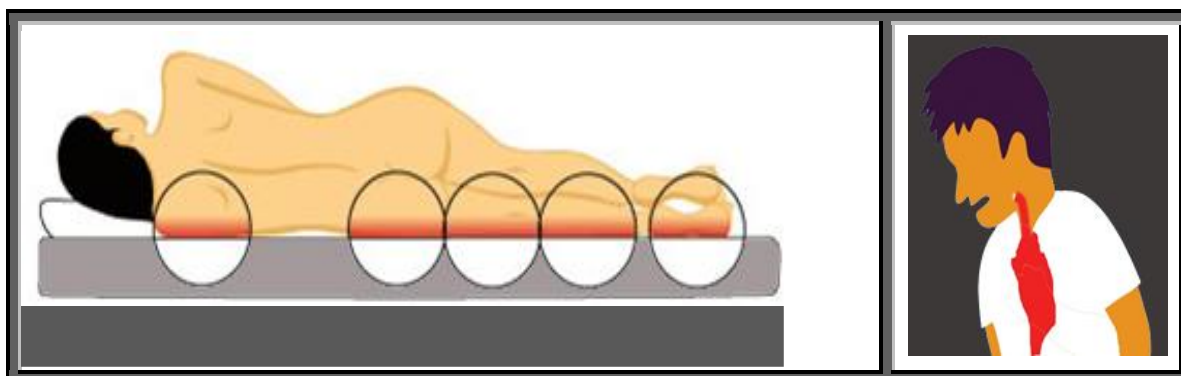


Figure no. (2) Shows how suffocation occurs during sleep. Source: (mexatk.com)

Doctors always advise their patients to raise the back of the bed as a whole so that reflux does not occur or cause suffocation to the sleeping person, which in turn leads to feeling tired after sleeping for long periods of time, as well as causing back pain and neck tension, as shown in figure 3.

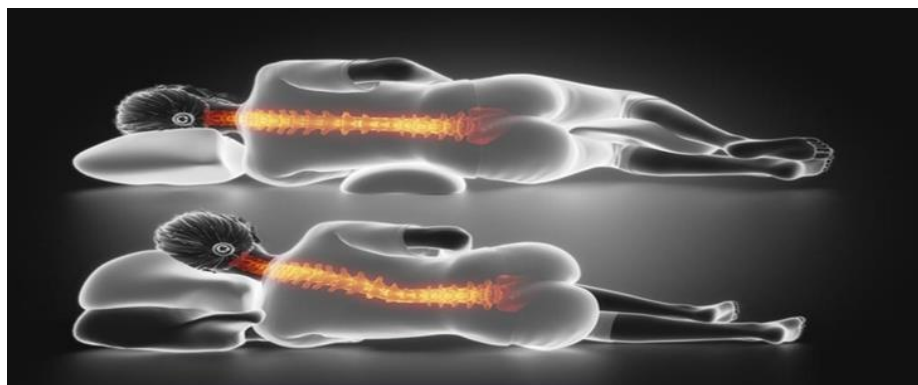


Figure no. (3) Shows how back pain and neck tension appear through the sleep position.

Hence the role of the designer in developing a solution to address these problems by providing and creating new bed designs that take into account moving the bed surface with the possibility of tilting it according to the patient's condition, size and weight, taking into account that we change our sleeping position from 30 to 60 times during sleep, It is important that the spine be permanently rested. Also, the designers should try to create many designs for bed assembly connections to modify the existing bed shape.

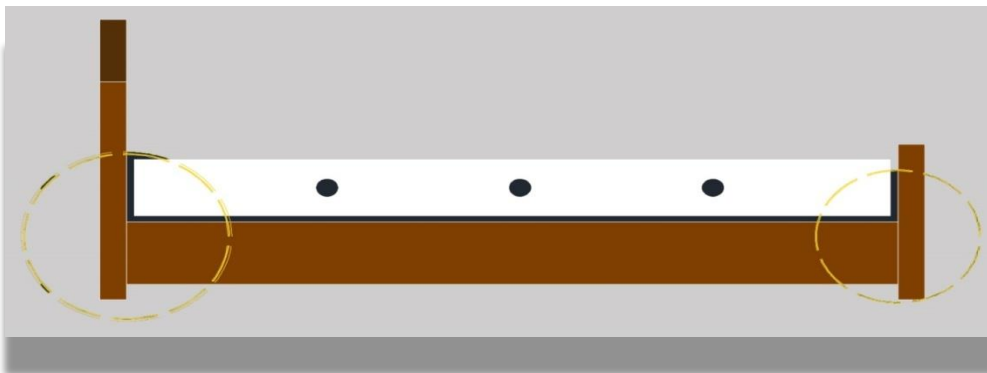


Figure no. (4) Shows the usual horizontal sleeping position.

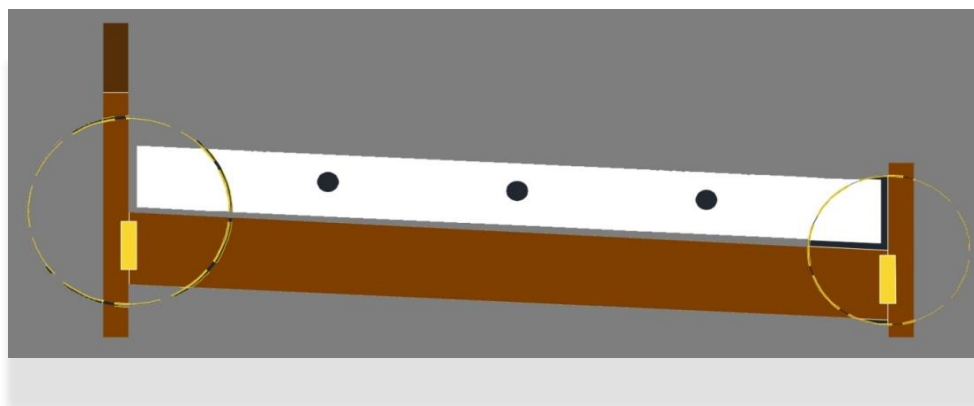


Figure no. (5) Shows the sleeping position developed and assumed by the research.
Source: by researchers

Traditional bed designs:

The bed design passed through several stages and developed according to different styles, in order to meet the desires of consumers according to fashion, or according to the new design assumptions by designers for architectural spaces, also the design configurations were according to the public and private taste of both beneficiaries and customers.

Assembly Units can be implemented and installed on all different models as shown in the following pictures, and that In Order to Meet the Needs of Customers to have a Sustainable Bed.

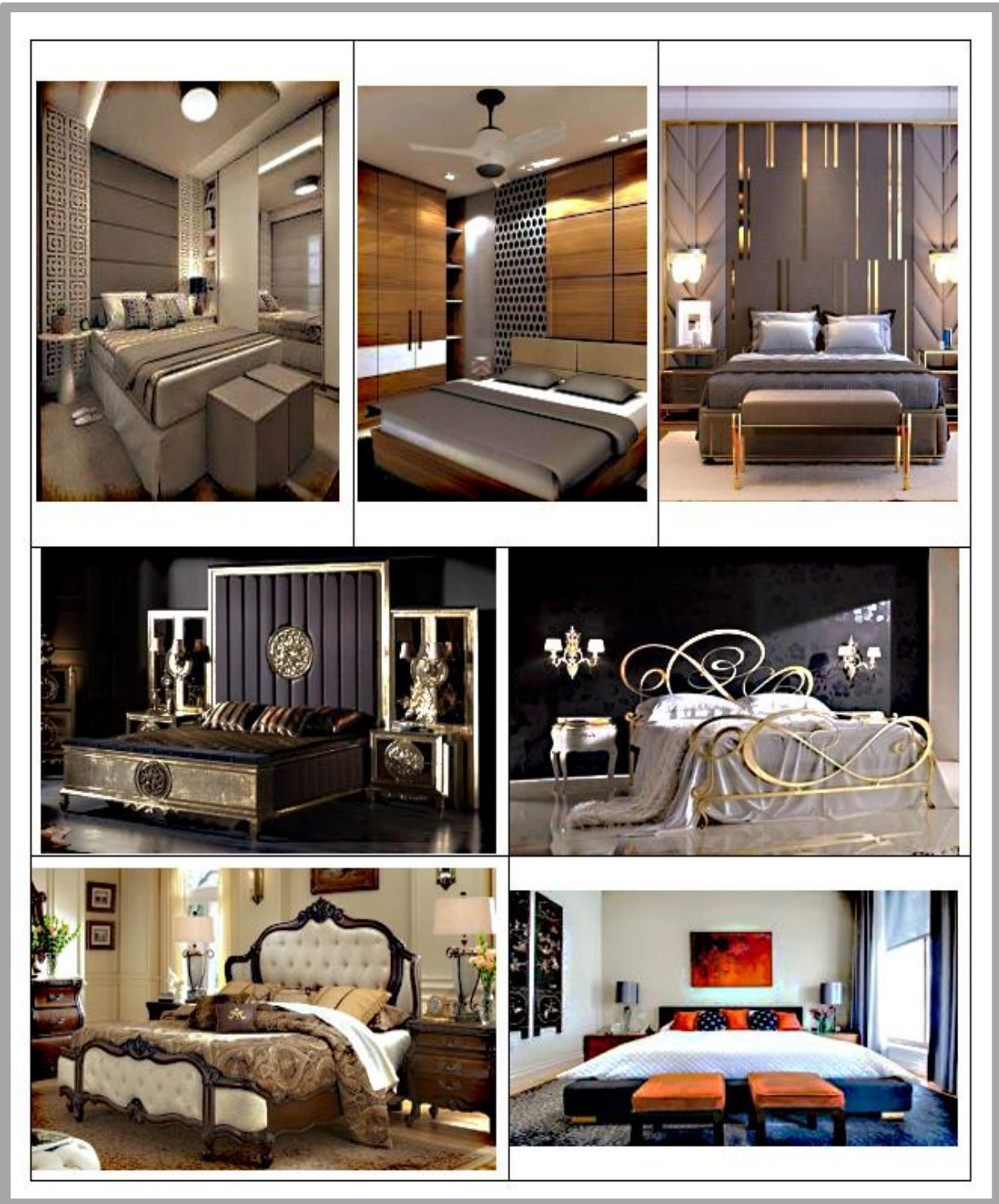


Figure no. (6) Illustrates various bed styles. Source: Internet websites Shown in references List

Multifunctional bed designs.

The bed design has gone through many different forms in order to fulfill different desires or to add some unique aesthetic values and functional values. The following figure no. 7 represents some of the different models and images that try to achieve both values.



Figure no. (7) Shows various bed designs to achieve multi- functions and aesthetic values.

Hospital and medical clinics beds.

Britain's hospitals introduced the first bed with moving bars in the period between 1815-1825, and in the year 1874 the company «Andrew West» developed the first mattress that can be raised to help the patient to develop his entire body like that used in hospitals now, and it is indicated that the first hospital bed was invented by William Gatch (Head of the Department of Surgery at the Indian Medical University) in the early twentieth century, and this family and was named after him (Elmestkawy, 2019).

As for the new electronic beds, it was invented in the year 1954, and it also contained a toilet for patients who could not get off the beds, and wheels were added to it as a necessary factor to facilitate the movement of the bed, also the ability of moving it for a few feet forward to be easier for patients in sometimes. Most of the wheels are designed to be secure to protect the patient, especially when moving from one bed to another, as shown in figure 8, also the hospital bed can be raised up or lowered from the side of the head and feet, and the cranes that raise or lower the beds are located at the front of the bed, as shown in figure 9. There are also many governmental hospitals that still have fixed beds and still use them, as shown in figure 10.

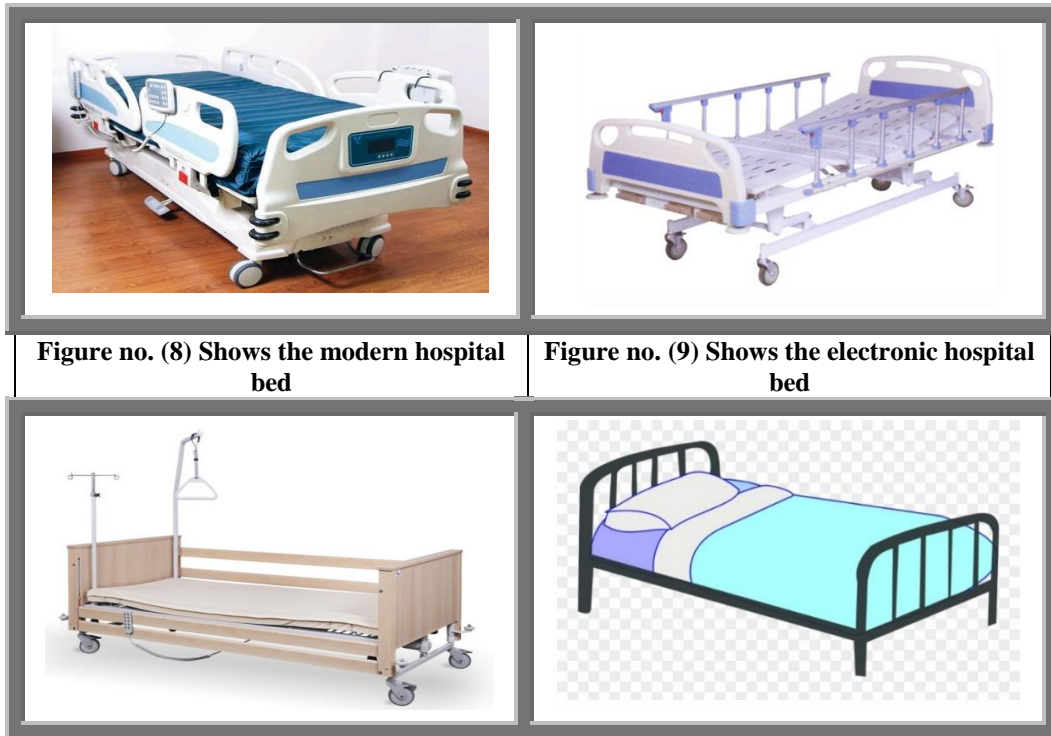


Figure no. (8) Shows the modern hospital bed

Figure no. (9) Shows the electronic hospital bed

Figure no. (10) Shows traditional patient's bed in some hospitals and clinics.
Source: Internet web sites

The applied framework for research.

➤ The first axis: creating bed designs.

Many modern bed designs are compatible with the purpose of this research which can be developed by updating production processes or by using different concepts in production. The following images represent a set of simple design ideas that the research concept can be implemented on.

So when a designer starts working on a new idea, the design dimensions must be taken into consideration, also dealing with the technological and economic dimension. In addition to the cost of manufacture according to the cost of model sample. The designer needs to register his idea and introduce it to market (Jalal, 2018).

In order for the product to perform its specific functions, the design must be constructed and arranged in functional way, in which the parts can be combined to correspond to each other to form the product at the end (Hilal, 2018).

- **First direction: flat on chassis / fixed structure with drawers.**



Figure no. (11) Fixed structure design with drawers.

- **The second direction: a flat surface on a storage tray.**



Figure no. (12) Designing a flat bed with a moving storage tray.

- **The third direction: adjacent design /bed adjacent to the bed.**



Figure no. (13) Bed design with an adjacent bed.

➤ **The second axis: Designs for the assembly connections.**

Assembly connectors are a central component in all furniture products and are part of different types and shapes which clarifies the research hypothesis. We had to set a group of design alternatives for the assembly of the bed of different types and models in order to achieve different inclinations to help reduce symptoms of esophageal reflux and pharyngeal reflux Larynx, as well as to eliminate the disturbing sounds of snoring while sleeping.

The research emphasizes the provision of new assembly links that modify the corners of fixed beds at homes through the following:

- Designing an assembly connection for the innovated beds.
- Designing an assembly connection that matches existing designs.

1- The first design idea.

The design sketches for the first idea are as follows:

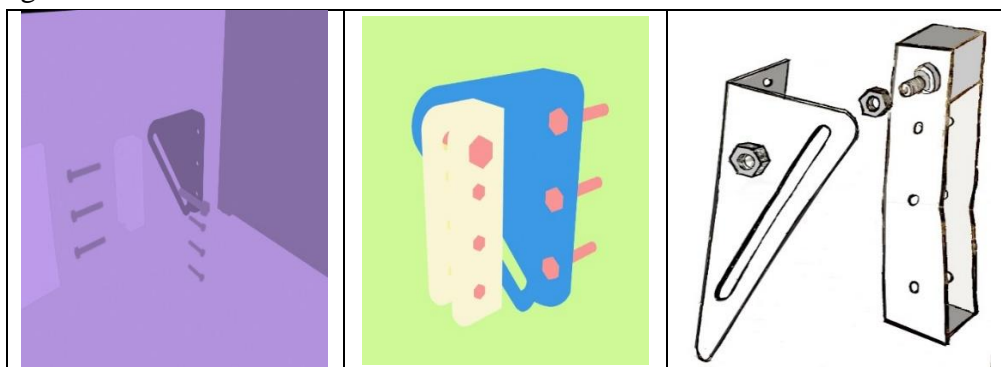


Figure no. (14) Illustrates the sketches of the first design idea.



Figure no. (15) Shows the method of installing and assembling the first design idea.

2- The second design idea.

The design sketches for the second idea are as follows:

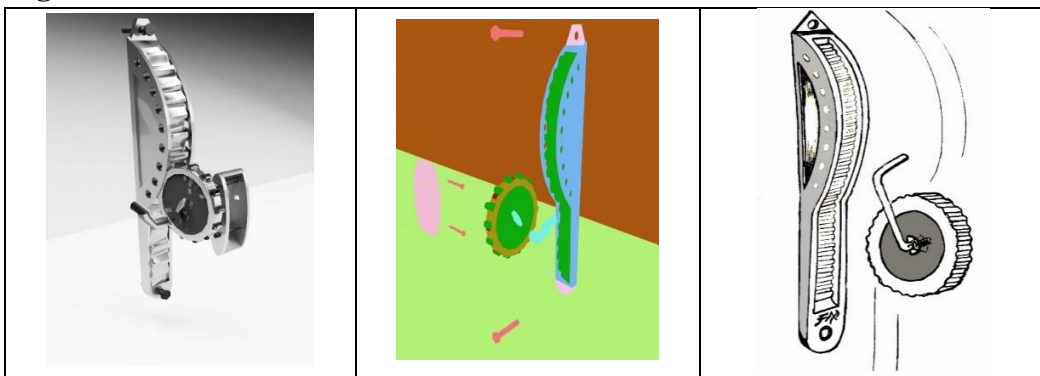


Figure no. (16) Shows a sketch of the second design idea.

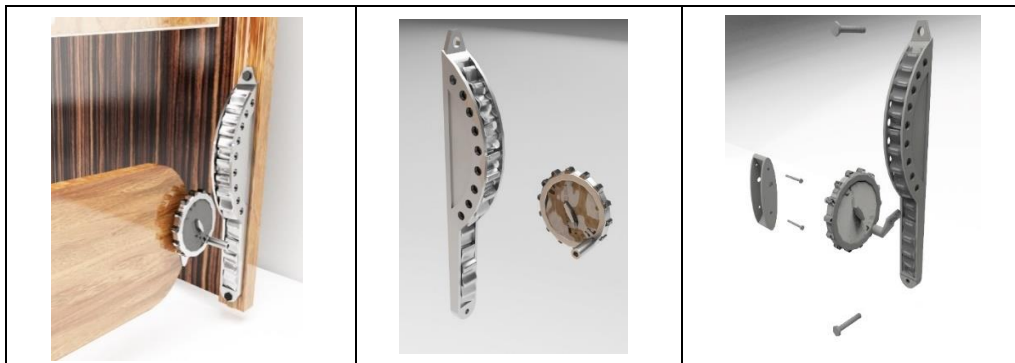


Figure no. (17) Illustrates the method of installing and assembling the second design idea.

3-The final design idea.

The design sketches for the third idea are as follows:

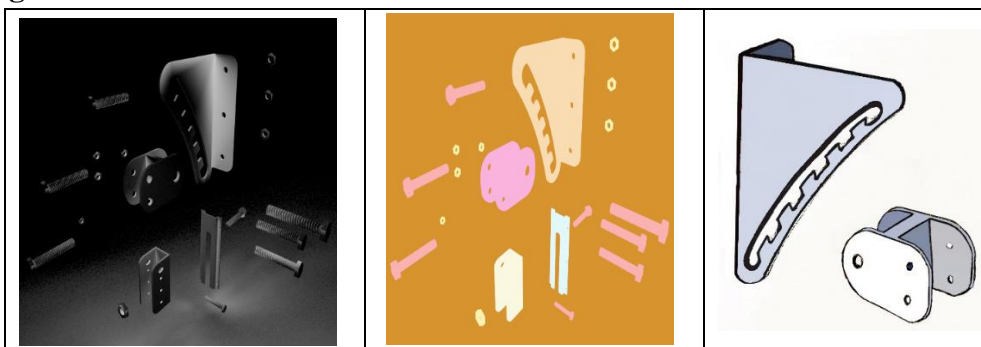


Figure no. (18) Shows a sketch of the third design idea.

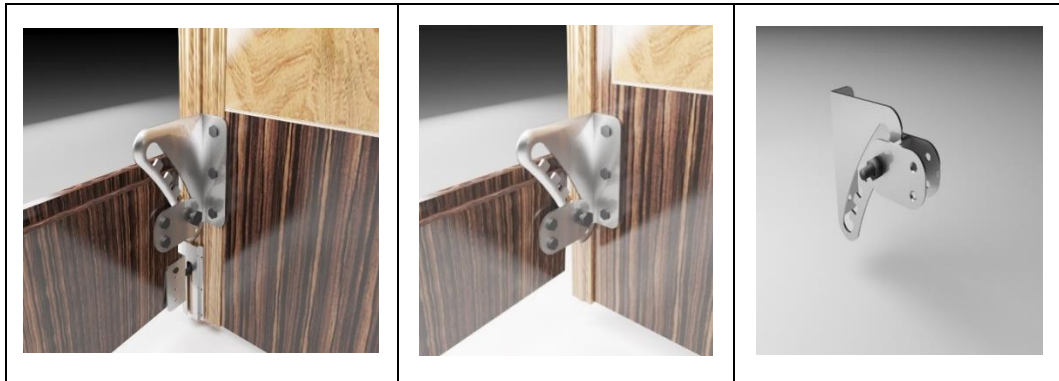


Figure no. (19) Illustrates the method of installing and assembling the third design idea.

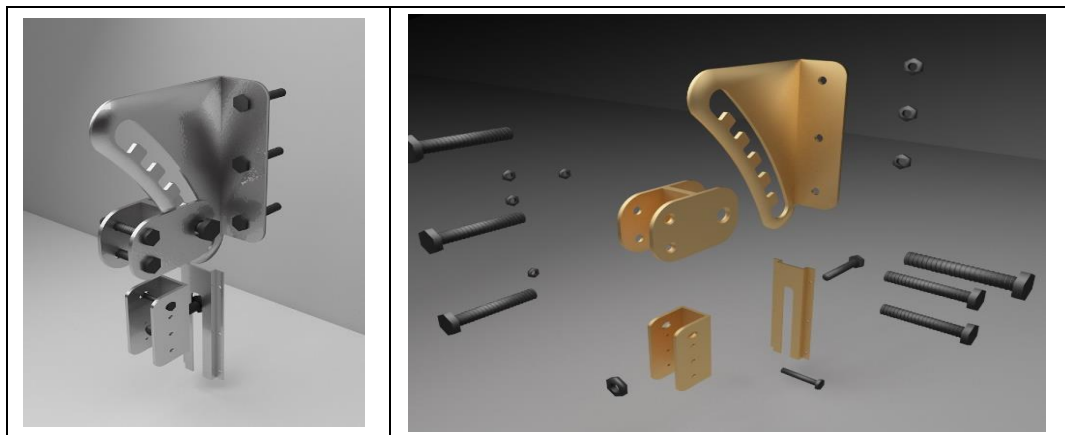


Figure no. (20) Illustrates perspective of the third design idea.

Results.

The search results are as follows:

- Designing an assembly joint at a low cost of local materials, which helps to change the position of the angles of the bed surface as a whole during sleep periods, so as to reduce esophageal reflux and pharyngeal reflux during sleep periods, and eliminate snoring sounds caused by sleep.
- The assembly link is compatible to be installed on most of the beds in Egyptian homes without the hassle of changing or replacing the furniture in the house to reduce the burden on many patients.

Recommendations

The research recommends the following:

- Adopting future ideas in bed design and using different technologies taking into consideration the manufacturing processes to provide electronic capabilities existing in hospital beds to the home bed as possible.
- The necessity of providing various bed designs in the market with functional values to help patients feel better at home.

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