

Study of the Effect of Light and Color on the Medical Interior Design; Case Study: Shahid Rahimi and Shohada-ye Ashayer Hospitals, Khorramabad City, Iran*

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ABSTRACT

Today, by knowing the concepts of environmental psychology and the effects of color and light on the quality of the environment, it is of great importance to consider these issues in the design of spaces to provide a favorable and healing space for patients. It has been proven in various ways that color and light influence and affect the human mind and body and proper or improper use of them has many positive and negative effects on our lives. In designing healthcare centers, considering the significant nature of the land-user, that is associated with human's physical and mental health, and also the complex functional relationships governing in it, attention to the requirements of proper design, including the proper use of light and color, has a key role. Due to their importance, therapeutic spaces should be a calm environment, according to the needs of clients. The present study aims to investigate how these two elements, as effective factors in improving the disease, can be applied properly. Proper color design and application of appropriate light can enhance health in hospitals. In the present study, library studies are applied to develop the theoretical foundations, and data are collected using questionnaires distributed among patients admitted to Shohada-ye Ashayer and Shahid Rahimi hospitals in Khorramabad City. This study is applied-descriptive research. In the present study, it is attempted to answer the question: What are the roles of color and light in accelerating the healing of diseases? To this end, first, the concepts of color and light are discussed and then the effects of them on physical and mental diseases and their application in therapeutic spaces are examined.

Keywords: Color, Light, Architecture, Mental and Physical Health, Hospital.

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1. INTRODUCTION

Human life is influenced by the human-environment relationship. Man is dealing with light and color since he opens his eyes to the world. Colors are one of the most important elements playing a role in creating the human-environment relationship. A healing environment with appropriate physical dimensions is indirectly effective in improving the patient's health status (for example, by reducing the patient's length of hospital stay and his/her stress). One of the important factors considered in creating a healing environment with the help of architecture is the proper application of light and color.

If the factor of color is used properly in hospitals and healthcare centers on various scales, from micro to macro, we can take effective measures in creating mental focus and increasing the feeling of calmness in the environment through principled and scientific planning. Light has a very important role in human visual activities and on the other hand, it greatly influences mental and physical health. Many studies have shown the importance of light in reducing depression, reducing fatigue, enhancing alertness, and regulating circadian rhythms (Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004).

Color and light have a natural and effective force. They can influence the human spirit and soul. The hospital represents the architecture of space where color and light can be used as two architectural elements affecting the users of this space, who are mainly patients. Finally, it is hoped that the present study takes a small step in explaining the contents related to the proper use of color and light in architectural spaces and the design of them, especially in the design of therapeutic environments.

2. LITERATURE REVIEW

The effects of color and light on human life as well as the treatment of patients cannot be denied. The effects of color and light on human life and health are discussed below.

2.1. The Nature of Color

Life is full of colors and their effects. When it comes to color, all of us will have a thought of it, and different colors will immediately come into our minds. The importance and role of color in human life bring different concepts of it to our minds (Ethan, 1986, p. 49). Color has long played a key role in human life so that it has never been seen as an unknown and strange word. In some ancient cultures, including the Egyptians, Chinese, and Greeks, the color was used for treatment. Aristotle was the first person who raised the color theory and discussed the effects of it on the function of the human body.

Colorists believe that the imbalance of the body indicates the lack of one or more colors and it can

be fixed using the desired colors (Malkin, 1992, p. 20). Goldstein, an outstanding researcher who has performed a lot of studies on color and its biological experiments, believes that color directly affects human behavior and all of his organs. Color can influence the human spirit and soul. According to psychologists, if people improve their sense of color, they will better control their emotions and thereby establishing better harmony between their bodies and souls (Ibid, p. 520). It has been proven that color affects the human psyche. Color can influence the human spirit and soul. It is healing and exhilarating. If a person can enhance his sense of color, he will better control his emotions and can create harmony between his body and soul.

2.2. The Nature of Light

Light, whether natural or artificial, is one of the most important and prominent environmental factors. There are many studies on it. According to them, light exposure affects hormonal rhythms, metabolic balance, and circadian rhythms. Neuroscientists believe that light is the most important natural input, after food, in controlling bodily function. In clinical plans, light has been used as a therapeutic agent (Barati & Barati, 2005, p. 8).

The human psychological system and the behavior system associated with it have evolved over time, this evolution has been wholly influenced by sunlight, and the light-sensitive and light-regulated organs have adapted to it. Many studies on the benefits of full light exposure have shown faster reaction time, greater visual acuity, less physiological fatigue, less movement in a more balanced and improved way, and better task performance (Hong, 2002).

The effect of light on body and spirit is such that it can be felt even with closed eyes. In winter, for example, boredom and sadness affect a person so that cloudy days and long nights make him feel depressed.

2.3. Color Therapy (or Chromotherapy)

Proper use of color in therapeutic centers is effective not only in raising patients' spirits and making the atmosphere happy but also in the treatment of various diseases through its effect on patients' bodies and spirits. "Color therapy (or Chromotherapy)" is an alternative remedy that uses color to treat some diseases. Color therapy, as one of the complementary medicine techniques, is the art of exposing the human body organs to different colors in order to contribute to the general health and well-being, an invisible layer of energy encompassing the human body (Mahmoudi & Shakibamaneh, 2005, p. 72).

To perform color therapy, it is required to adequately know the physical and emotional effects of colors. Studies show that colors directly affect human behavior. For example, painted walls, colored clothes, and fabrics in therapeutic spaces influence patients' response to treatment. According to the architects and

interior designers of hospitals, applying appropriate design techniques makes a sense of security and a feeling of confidence in patients. These play a key role in accelerating the improvement of their physical and mental health (Dargahi, 2005). In hospital space, the effect of color is significant so that it can even reduce the patients' nosophobia and treatment duration.

2.4. Light Therapy

Light therapy (or phototherapy, classically referred to as heliotherapy) refers to a therapeutic remedy according to which patients are exposed to daylight or a specific

wavelength of light using lasers, light-emitting diodes, fluorescent lamps, dichroic lamps, full-spectrum app-controlled LED grow light. Light is prescribed for a given period of time and, in some cases, a specific time of day (Miller, 1994, p. 56). Daylighting is a process beyond providing proper conditions for seeing objects. "This process has specific emotional qualities that can clearly affect people's moods" (Mc Cloud, 1995, p. 65). It is necessary and essential to apply light in any space. It improves the health of patients, so the presence of proper light in therapeutic spaces creates a kind of motivation for recovery.

Table 1. Review of Case Studies on the Effects of Color and Light on Patient Health

| No. | Case Study | Color | Light | Effect |
|-----|--|--|-------------------------------|--|
| 1 | Akhavan Super-Specialty Hospital, Kashan, Iran | Use of various colors in various wards | Use of wide windows in facade | Provision of bright interiors and variety of color |
| 2 | Abu Ali Sina Hospital, Shiraz, Iran | Use of bright soothing colors | Wide windows | Transferring great amount of light inside and soothing colors of various wards |
| 3 | Tabriz's Super-specialty Hospital, Iran | Bright and cheerful color | - | Creation of childish and dynamic space |
| 4 | Skerries Hospital, France | - | Wide windows | Lightful spaces improve patient health. |

According to the abovementioned case studies, it can be said that in therapeutic spaces, the appropriate color and light should be applied in proportion to their functions to provide a happy and relaxing environment for patients.

2.5. The Effect of Color on the Body

Red: Red color accelerates the pulse, raises blood pressure, and increases the breathing rate (Malkin, 1992, p. 55). It is the most suitable color for the treatment of anemia and blood diseases. It is a stimulant and energizing color and can be applied in the treatment of bronchitis, rheumatism, and tuberculosis. This color can be useful in treating colds and lung infections (Mu'adi, 2000, p. 57) and has a special effect on infertility treatment (Veziar Behdasht, 2013, p. 276).

Yellow: Yellow color stimulates the central nervous system and muscle strength, so it can be effective in treating paralysis. It is a useful color in the treatment of rheumatism. It is used to treat severe migraine headaches (Mu'adi, 2000, p. 58). Hyperactive and nervous people and those with hyperthyroidism should not be exposed to yellow for a long time. This color is not suitable for obese people and those with hypertension (Loshier, 1994, p. 91). Yellow is used in color therapy to treat liver and stomach disorders (Malkin, 1992, p. 20).

Blue: Blue color reduces blood pressure, breathing rate, and heart rate (Ibid, p. 55). It is a soothing color and is useful for people who become excited and nervous very quickly. This color strengthens the body's defense system and is useful for treating diseases such

as asthma, chickenpox, and jaundice (Mu'adi, 2000, p. 59). This color should not be used when having a cold. Blue is used in color therapy for thyroid and laryngeal diseases (Malkin, 1992, p. 20).

Green: Green color has anti-infective properties and is used in the treatment of infections. The application of this color is useful for treating insomnia, severe back pain. Heart problems, hypertension, hypotension, migraine headaches, and lethargy are treated with green color (Mu'adi, 2000, p. 58). This color enhances the growth rate of cells in the body (Veziar Behdasht, 2013, p. 279) and is used to treat heart diseases (Malkin, 1992, p. 20).

Orange: Orange light is used to treat kidney stones and gallstones. This color is used to treat asthma, bronchitis, hyperthyroidism, weak lungs, and prevention of malignant glands (Mahmoudi & Shakibamanesh, 2005, pp. 73-74). Also, the application of it is effective in treating gastrointestinal diseases. It is better for people with hypertension to not be exposed to this color. Excessive use of orange color causes disharmony of the nervous system (Veziar Behdasht, 2013, p. 278). Therefore, it is recommended to use this color with a green or blue one. In color therapy, this color is applied to treat lung and kidney diseases (Malkin, 1992, p. 20).

Purple: This color is known to have a calming effect on the heart and helps purify the blood. It removes toxins from the body and stimulates the body to build defense cells (Mahmoudi & Shakibamanesh, 2005, p. 74). It is generally applied to treat rickets, sciatica, epilepsy, pneumonia, and asthma. Watching purple can help improve heart function in addition to the nervous system (Mu'adi, 2000, p. 60).

Gray and Neutral Colors: According to some physiologists, eyes, and nerves are always more attracted to gray color, and this color has a very soothing effect" (Ethan, 1986, p. 69).

2.6. The Effect of Light on the Body

Light regulates the human circadian rhythm by hitting the retina and thereby affecting the hypothalamus. If the body's internal or biological clock does not match the 24-hour circadian rhythm, patients and even staff feel tired, bored, or distressed. The human circadian system is composed of three components: 1- Internal sensors located in the hypothalamus in the brain; 2- A number of external sensors (stimulated by external stimuli such as the day/night cycle) that influence internal sensors; and 3- Melatonin, which is secreted by the pineal gland and transmits information about "time" to all parts of the body through the blood flow (Boyce, Hunter, & Howlett, 2003; Edwards & Torcellini, 2002).

Exposure to light stimulates melatonin secretion (Veitech & McColl, 1993). The level of melatonin in an individual's body determines his/her amount of activity and his/her body's energy level. Exposure to artificial light is not adequate to the sufficient and proper secretion of the hormone and it is required to be exposed to sufficient natural daylight. If melatonin is not secreted, the body's circadian rhythm will be disturbed and cause depression, and the low secretion of it also makes an individual feel drowsy and tired (Lewy, Nurnberger, Wehr, Pack, Becker, & Powell, 1985). Exposure to daylight in open spaces is a key factor in regulating body circadian rhythm. Daylight prevents the incidence of depression, drowsiness, and irregular circadian rhythms in patients during their hospital stay (Boyce, Hunter, & Howlett, 2003; Edwards & Torcellini, 2002). Studies have indicated that large amounts of vitamin D in the blood can only be obtained from sunlight exposure and getting enough vitamin D is required for absorbing calcium (McColl & Veitch, 2001).

Lighting and the use of appropriate light in the interior of hospitals specific for cancer patients help regulate the body's biological clock, enhance visual clarity in the environment, reduce occupational error, length of hospital stay, sense of pain in patients, and depression, increase positive feeling about the hospital environment, etc. In addition to its effect on vital rhythms, "daylight creates continuous and varying effects of contrast and brightness in the human living space and enables the human eye to adapt uniformly, which in itself reduces ocular fatigue." The human eye is able to adapt to high light intensities without feeling uncomfortable" (American Institute of Architects, 1993).

However, it should be kept in mind that the use of very bright lighting is not recommended in all cases. "Excessive luminance may cause irritation and allergy, eye deviation and ocular fatigue, headache and insomnia. The ultraviolet rays from sunlight

are essential for human comfort and health. They prevent osteomalacia, keep skin healthy. These rays are germicidal and also effective in some chemical reactions in the human body. The capillaries dilate and the blood pressure drops slightly when the body is exposed to these rays. In addition to feeling healthy, they lead to an increase in pulse rate and appetite. However, it should be avoided to expose to excessive UV rays because this can cause skin wrinkles and even malignant skin tumors. Other applications of phototherapy include pain control, acceleration of wound healing and hair growth, improvement of blood circulation, and treatment of sinus disorders" (Evans, 1981, p. 63).

2.7. The Effect of Color on the Human Soul and Spirit

Red: Red is a symbol of life (Ethan, 1986, p. 214). In psychology, the red color means self-confidence, so it is used to treat the phobia. It intensifies emotions, creates excitement, and gives energy. Excessive use of red color can lead to emotional distress and irritate the nervous system (Seyed Sadr, 2005, p. 205).

Yellow: Yellow is a symbol of light and enlightenment (Ethan, 1986, p. 210). It is one of the most important colors recommended by psychologists for the treatment of depression (Veizarat Behdasht, 2013, p. 277). This color creates a spirit of vitality in people and improves the desire to live in humans. Hyperactive and nervous people should not be exposed to this color for a long time (Loshner, 1994, p. 87).

Blue: Blue is always associated with introspection (Ethan, 1986, p. 216). This color makes us calm. It deeply soothes the nervous system and eliminates obsessions (Mu'adi, 2000, p. 59). It is a helpful color for people with sleep disorders (Loshner, 1994, p. 73). Excessive use of blue color may cause fatigue and depression (Mu'adi, 2000, p. 60).

Green: Green represents peace and hope (Ethan, 1986, p. 218). The use of this color is the best treatment for stress disorders and mental disorders. It is a calming color and eliminates fatigue as well as increases tolerance. It is very effective in enhancing the feelings of friendship, hope, faith, and peace. Excessive use of this color is not suitable for people with depression, because it reduces their activity and liveliness (Loshner, 1994, pp. 83-84).

Orange: Orange is known to be an anti-fatigue color (Mu'adi, 2000, p. 58). It is one of the colors making an individual jolly and happy and psychologists recommend this color for the treatment of depression. This color increases social emotions. It is not logical to use this color for those who have no inner peace (Loshner, 1994, p. 58).

Purple: Purple evokes emotions (Ethan, 1986, p. 219). This color is used to treat mental disorders such as schizophrenia and periodic dementia. Purple represents meanings of spirituality, dignity, and honor. The use of this color is mentally very effective in reducing hatred

and anger (Mahmoudi & Shakibamanesh, 2005, p. 76). Lilac color is a depressing and dreary color and is not suitable for people with depression (Ethan, 1986, p. 219).
Gray and Neutral Colors: Neutral colors and those

colors combined with or faded to gray are known to be soothing and relaxing colors. Excessive use of gray in the hospital should be avoided since it causes low visual stimulation, makes the atmosphere boring, and may lead to depression (Loshier, 1994, p. 72).

Table 2. Outstanding Characteristics and Effects of Colors on Physical and Mental Diseases

| Color | Characteristics | Body | | Spirit | |
|------------------------|--|--|---|--|---|
| | | Disadvantage | Advantage | Disadvantage | Advantage |
| Red | Blood pressure and heart rate-raising, stimulant and energizing | Hypertension nervousness, high fever and obesity | Anemia and iron deficiency, colds, infertility infections, bronchitis and rheumatism | Nervous system and mental disorders | Elimination of fear, and depression, symbol of living and increase of self-confidence |
| Yellow | Creation of a spirit of vitality, increase of focus and concentration, stimulation of nervous and muscular systems and increase of seclusiveness | Nervousness, obesity, hyperthyroidism and eyestrain | Paralysis, rheumatism and arthritis, liver tiredness, pancreas and stomach and constipation | Mental disorders, tendency to isolation and seclusiveness | Depression, boredom and lack of concentration |
| Green | Lively, hopeful, calming, increase of tolerance, enhancing feelings of friendship, hope and faith | Hypertension, low breathing and heart rates and malignant glands | Infection, insomnia, pain, asthenia, heart disorders, blood pressure, strong agent for repair of muscle cells and bones | Depression (if used for a long time and in large quantities) | Stress and mental disorders, fatigue and low tolerance |
| Orange | Blood pressure- and heart rate-raising, antispasmodic, stimulant, energizing and appetizing | Hypertension, body imbalance and imbalance of nervous system | Kidney and gallbladder stones, cold, bronchitis, malignant glands, constipation, lung disease | Nervous system, tension, stress and insomnia | Depression, boredom and isolation |
| Purple | Heart-soothing and blood-purifying, depressing and dreary, toxin-removing | Nervous system (if used for a long time and in large quantities) | Spleen and bladder diseases, rickets, back pain, sciatica, epilepsy, pneumonia and poor immune system | Depression, dreariness and emotional distress | Mental disorders such as schizophrenia and madness, hatred, anger and fear |
| Gray and Neutral Color | Eye and nervous calming, low visual stimulation and boring color | Nervous system (if used for a long time and in large quantities) | Nervous tension, hypertension | Boredom and depression | Mental strain and disorders, stress |

Now, with the knowledge of the characteristics of colors as well as their positive and negative effects on the human body, they can be consciously applied in different parts of the hospital to benefit their therapeutic properties for the treatment of diseases or reduce their harmful effects on diseases.

2.8. The Effect of Light on the Human Soul

Among the five basic human senses, sight is the most important transmission sense. The role of “light”, on which the whole universe is created, is of great importance. In human thought and mind, sunny and bright days are always associated with love and

happiness and a special kind of encouragement and excitement with hope. Seeing the sunlight creates a kind of movement and positive energy, and in contrast, cloudy and rainy days are always associated with feelings of loneliness, worry, depression, and demotivation.

In hospitals, daylight makes the environment lively. Under proper levels of lighting, patients have less fear of the hospital environment and it is easier for them to accept the space (Barati & Barati, 2005). One of the lighting techniques used in hospitals is the use of fluorescent lights, which are effective in increasing the patient's fear of the environment. Since patients spend most of their time in the hospital during the treatment period, proper lighting is one of the most important factors in designing the patient's room, especially where the patient's bed is located. As the atmosphere of a home becomes warm, lively, and acceptable using light, the hospital atmosphere should evoke the same feeling for the patient as much as possible (Hong, 2002).

2.9. Application of Color

Color can greatly influence people's perception and response to the environment and has a direct effect on patients' recovery. Studies indicated that like light, colors can improve patient recovery by up to 10 percent. Here, the important note is the designers' comprehensive knowledge of the use of color in reducing environmental stress. In the use of color, the first principle is to make the environment relaxing as much as the home space and to strengthen the symbolic aspect of the healing environment. For patients, positive outcomes of using proper colors are obtained when natural light, natural elements, happy colors are applied in the design of patient rooms and different wards (Dalke, Littlefair, Estates, & Loe, 2004). The environment surrounding the patient should assure patients about medical care and ensure their physical and emotional relaxation. Achieving this balance is not an easy purpose because the variety of color schemes depends on the length of hospital stay and the type of disease. Groups of patients have special needs and the quality of colors provides a better environment for them.

Elderly and visually impaired patients: Various changes are made in the visual system of the elderly as they become older. This group of people has difficulty with gazing and seeing at short wavelengths while seeing long wavelengths more intensely (Kulivand & Kazemi, 2012, p. 25).

Pregnant women: As mentioned earlier, red increases heart rate, blood pressure, and breathing rate. Therefore, it is not recommended to use this color for this group. Blue has the opposite effect. It is not desirable to apply gray color in the pediatric and maternity wards where people expect to be in a happy environment (Dalke, Littlefair, Estates, & Loe, 2004, p. 17). It is popular to

use light orange color in this area (Kulivand & Kazemi, 2012, p. 46).

Pediatric patient: Children also have their specificity in the area of colors. The color used in the environment of this ward plays an important role in creating enthusiasm and enhancing children's ability to better understand the space. According to some researchers, light and bright colors of red and yellow are more related to childhood" (Malkin, 2002, p. 516).

Mental patients: Patients with mental health disorders have special emotional experiences. Places surrounded with strong colors are considered threatening spaces for people with mental health disorders. Those colors making these spaces light and open must be used (Dalke, Littlefair, Estates, & Loe, 2004, p. 8). The use of strong and sharp colors increases schizophrenia attacks (Malkin, 2002, p. 519). It is intolerable for this group of patients to see orange and red (Kulivand & Kazemi, 2012, p. 46). It should also be noted that excessive use of green and blue colors, which are known to be calming and soothing colors, may worsen depression (Dalke, Littlefair, Estates, & Loe, 2004, p.20).

Other patients: The patient room is a place where he/she spends most of his/her time. The use of strong colors in it can make patients feel anxious. In contrast, relatively light colors help to reduce emotional excitement. Although the use of neutral and light color schemes leads to demotivation in patients with long-term hospitalization, the use of them is helpful in environments required to be calm and quiet. Light green, gray and walnut colors are suitable for patient rooms (Mosaddegh Rad, 2004, p. 89). The color contrast between floor and walls and other surfaces makes the environment more suitable for people with visual impairments (Birren, 2005).

2.10. Application of Light

The hospital lighting system includes general lighting for all wards, examination room, injection room, intensive care unit, and patient rooms. For this reason, the lighting design of different spaces and facilities of the hospital should be carried out considering the optimal visual needs of patients and even practitioners and staff. The main goal of any health care system is to provide a proper environment to restore patients' health. These systems include hospitals, mental health centers, surgical centers, clinics, and healthcare centers. A comfortable vision should be provided for patients and their carers, practitioners, and the other hospital staff of a wide range of ages, and uniformity of light sources is essential (Parsons, 2000, pp. 31-94).

The use of natural light is very favorable in health care centers in different seasons. In addition to energy efficiency, its primary effect is to enhance circadian rhythms, which have been proven to have a key role in the recovery process (Carler & Bena, 1999, p. 140). Many studies in the United States have shown that the design of spaces with proper lighting at standard angles

is of important issues that their roles are ignored in accelerating patients' health and increasing the vitality of hospital staff. The biological meaning of light and the impact of sunlight are effective in recovery. Also, in long-term hospitalization, the presence of special lights is necessary for metabolic tasks and blood circulation to function properly. Sudden exposure to light stimulates the adrenal glands. In these cases, day/night cycle may be inspired and natural-light-like lighting may be provided. Also, it is required to examine the ceiling lights and their material and details. Light may enhance health and may cause depression, lethargy, and drowsiness. Architects can use this knowledge to enhance patient recovery and facilitate access to inner peace. In order to provide favorable conditions in the hospital, different data on daylight should be used. In addition to its positive effects on the human spirit and soul, sunlight is a symbol of hope and recovery for patients with long-term hospitalization. Moreover, sunlight has disinfecting effects, especially in environments where there are human and plant pollutions. It has been proven many times that rooms with no natural light look more depressing and with the heavier atmosphere. Sunlight is a rich source of natural light and clarifies architectural forms. Even if the sunlight is intense, the quality of its light directly or indirectly influences the patient. Sunlight enters the space through the skylight and hits the surfaces inside the room. It also invigorates the room space and separates the shapes inside it by creating light and shadow designs. Since the intensity and direction of sunlight are almost certain, its visual effect on surfaces, forms, and room space can be controlled and predicted

using the size, location, direction of skylights in the enclosed space. The dimensions of a skylight play a role in determining the amount of sunlight input. Moreover, in addition to the dimensions of the openings in the wall or ceiling, the sunlight input depends on other factors such as materials, wall or ceiling structure, ventilation, the desired degree of enclosure, and the effect of the openings on the facade. Therefore, in determining the amount of sunlight in a room, the position and direction of a window or skylight are more important than its dimensions. The direction of an opening can be adjusted so that it allows the entry of direct sunlight at a specific time of day. Direct sunlight provides the maximum amount of light and in the middle hours of the day, its intensity reaches its maximum. The harmful effects of direct sunlight, such as excessive heat radiation, can be controlled by applying canopies in the form of openings, or by providing shade using nearby tree foliage, or adjacent buildings. The orientation of an opening can be adjusted so that it prevents the entry of direct sunlight and instead, indirect ambient light is applied because the intensity of direct sunlight remains more or less unchanged even on cloudy days so mitigating and adjusting it in space is very important. It can also be noted that the use of all-around windows to direct natural light inside and provide proper lighting at night leads to a sense of calm and belonging in space (Alirezaii, 2010, p. 48). Although light is one of the main factors in the design of therapeutic spaces, it will not have a positive effect without performing necessary investigations. Moreover, in various wards and spaces, the effect of light intensity should be considered.

Table 3. Outstanding Characteristics and Effects of Light on Physical and Mental Diseases

| Characteristic | Body | | Spirit | | |
|----------------|--|--|---|---|---|
| | Disadvantage | Advantage | Disadvantage | Advantage | |
| Light | Secretion of melatonin secretion, Regulation of circadian rhythm, Increase of activity, Appetite and positive feeling about the environment | Incidence of fatigue, Irritation and allergy, Eye deviation and Ocular fatigue, Insomnia, incidence of cardiovascular disease, Gastrointestinal diseases, Skin wrinkles and malignant skin tumors | Vitamin D, Reduced pain, Treatment of osteomalacia, Antimicrobial property, Regulation of blood pressure, Regulation of pulse rate, Control of pain, Improvement of hair growth, Enhancement of blood circulation and improvement of sinus disorders | Loneliness, Worry, Depression, Demotivation, Emotional and social problems and anxiety | Cheerful, Exciting, Hopeful, Positive energy and vitalizing |

Now, with the knowledge of positive and negative effects of light on the human body, the necessity of this issue and the effect of light on the patient body and spirit health can be mentioned. However, it should be noted that the light intensity in the hospital interior and exterior and the use of natural and artificial light should be controlled so as not to have a negative effect on patients.

3. RESEARCH METHOD

The present study is applied-descriptive research in which a case study was investigated. In this study, data were collected using library studies, field observations, and a questionnaire. Then, the data collected on the theoretical foundations were analyzed using SPSS software.

3.1. Questionnaire

The research questionnaire consists of 20 questions, six of which are about the effect of color and light on patient health. In developing the questionnaire, it was attempted to avoid complex, ambiguous, unclear, and negative questions.

3.2. Statistical Population

The statistical population of the present study included hospitalized patients and staff (Total N=80, 40 males and 40 females) of Shahid Rahimi and Shohada-ye Ashayer hospitals in Khorramabad City.

3.3. Presence in the Field

The next step after developing the questionnaire is to be present in the field to achieve the best solution and provide the generalizability of the answers. Eighty male and female patients of different age groups and with different levels of education, from illiteracy to having higher education, who were hospitalized in

Shahid Rahimi and Shohada-ye Ashayer hospitals, were randomly selected and surveyed. For this purpose, first, the patients were explained on the purpose of data collection, the necessity of patient cooperation in providing the required data, and also the confidentiality of responses. Then, the questionnaires were distributed and the respondents were assisted in the answering process. Those with less ability to answer the questions were interviewed face-to-face.

4. DATA ANALYSIS

Considering the nature of the research and its data, data were logically analyzed using inductive reasoning. Descriptive statistics (graphs and averages) were used to analyze the data. For this purpose, the answers of the survey questions and raw data were entered into SPSS software and the graphs of statistical results were extracted and analyzed. The questions had 5 options (too little/few, little/few, moderate, a lot of, much/many). The results of data analysis are presented in the following figures and tables.

Table 4. The Use of Bright Colors in the Hospital Interior

| Data from Questionnaire | | | | | |
|-------------------------|----------|-----|----------|----------|------|
| No. | Very Few | Few | Moderate | A lot of | Many |
| Number | 0 | 2 | 3 | 50 | 25 |

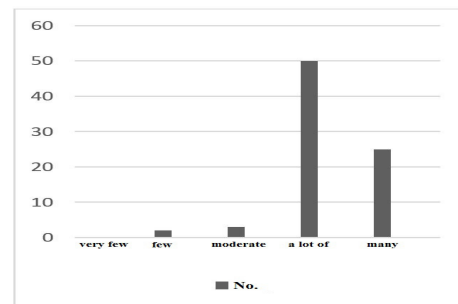


Fig. 1. The Use of Bright Colors in the Interior of Different Wards of the Hospital

Table 5. The Presence of Interior Spaces with the Same Color in Different Wards of the Hospital

| Data from Questionnaire | | | | | |
|-------------------------|----------|-----|----------|----------|------|
| No. | Very Few | Few | Moderate | A Lot of | Many |
| Number | 4 | 6 | 15 | 33 | 22 |

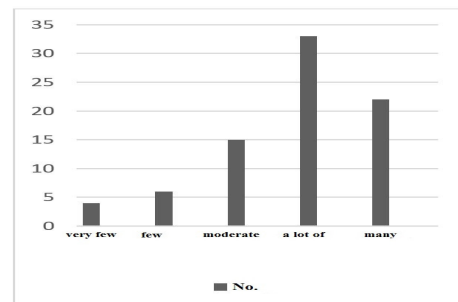


Fig. 2. The Presence of Interior Spaces with the Same Color in Different Wards of the Hospital

Table 6. The Use of Various Colors in Different Parts of the Hospital

| Data from Questionnaire | | | | | |
|-------------------------|----------|-----|----------|----------|------|
| No. | Very Few | Few | Moderate | A Lot of | Many |
| Number | 1 | 2 | 12 | 36 | 29 |

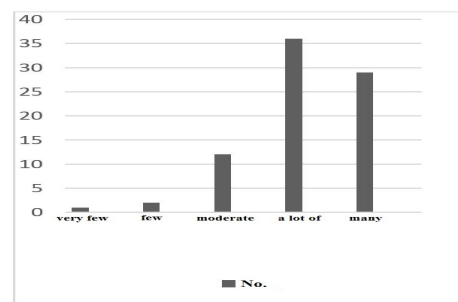


Fig. 3. The Use of Various Colors in Different Parts of the Hospital

Table 7. The Use of Daylight in the Interior of Different Wards of the Hospital

| Data from Questionnaire | | | | | |
|-------------------------|-------------|--------|----------|------|----------|
| No. | Very Little | Little | Moderate | Much | Too Much |
| Number | 0 | 2 | 7 | 61 | 10 |

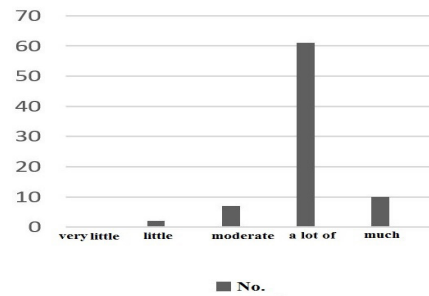


Fig. 4. The Use of Daylight in the Interior of Different Wards of the Hospital

Table 8. The Importance of Paying Attention to the Use of Fluorescent Lights in Hospital Interiors

| Data from Questionnaire | | | | | |
|-------------------------|-------------|--------|----------|----------|------|
| No. | Very Little | Little | Moderate | A Lot of | Much |
| Number | 0 | 2 | 7 | 58 | 13 |

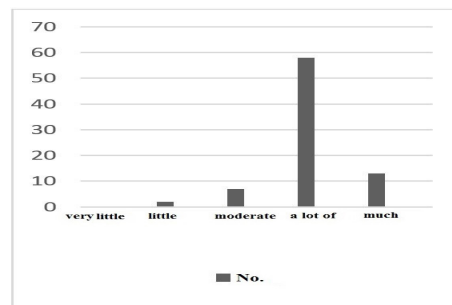


Fig. 5. The Importance of Paying Attention to the Use of Fluorescent Lights in Hospital Interiors

Table 9. The Presence of Windowless Corridors in the Hospital

| Data from Questionnaire | | | | | |
|-------------------------|----------|-----|----------|----------|------|
| No. | Very Few | Few | Moderate | A Lot of | Many |
| Number | 0 | 2 | 13 | 31 | 34 |

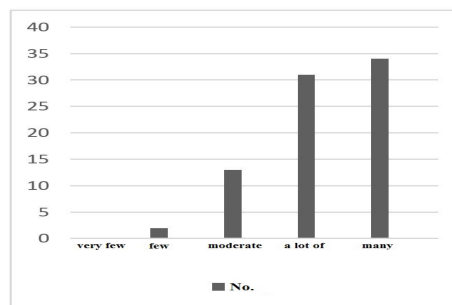


Fig. 6. The Presence of Windowless Corridors in the Hospital

In the questionnaire used in the present study, some questions were asked about the effects of light and color on the patients' recovery process. The result of data analysis shows that there is an ever-increasing need for light and color in the hospital design. According to almost all patients' responses, one can find the importance of light (for the lighting of patient rooms and lobbies) and its undeniable role in accelerating the recovery of patients. The use of light colors (blue, green, cream), and the combined use of fluorescent and ceiling lights were ideal for patients.

5. CONCLUSION

The results of the present study indicate that according to what patients need and demand in the therapeutic spaces, the stressful and inflamed environment of the hospital must be converted into a happy and calming one using appropriate color, light, and beautification factors for each space. Color and light are also effective

in human life and have an effective presence in it. They can be effective in balancing different areas of the body and treat many physical and mental problems of patients. Today, compared to the past, people spend most of their time indoors, so it is necessary to provide the ground for daylight to enter indoors to improve their quality of life and enhance their health. The results obtained from the questionnaires indicate that according to almost all patients' responses, one can find the importance of light and its undeniable role in accelerating the recovery of patients. Moreover, the use of various bright colors was ideal for patients. It should be noted that in aesthetics and people's environmental perception, several factors such as age, education, income, socio-cultural conditions, climate, etc. are effective. Therefore, the results of the present study cannot be generalized to all hospitals and medical centers.

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