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EVALUATION OF ORAL AND DENTAL HEALTH POLYCLINICS IN TERMS OF ERGONOMIC DESIGN FACTORS

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Abstract

The comfort conditions of oral and dental health clinics depend on physical and environmental factors. Patient, physician, and staff satisfaction is directly proportional to the suitability of the ergonomic conditions of the environment. While physical elements impact the well-being and productivity of doctors and staff during the workday, clinic layout, and design play a critical role in patient comfort and health. There has been insufficient research that addresses the physical risk factors that dentists, personnel, and patients face during clinical procedures from the perspective of the architectural discipline. The study aims to reveal the ergonomic comfort conditions of dentists, staff, and patients in the oral and dental health clinic. The research method is a field study carried out in Istanbul. Research techniques are "on-site observation," "measurement," "survey," and "interview". "Luxury Light Meter," "Sound Meter," and "Thermometer applications" were used to measure the light, sound, and temperature values of the space. A survey was administered to patients, physicians, and staff using the Likert Scaling Model. As a result, patients prefer to be treated in polyclinics where they feel comfortable, and dentists and their staff can work more motivated and productively in environments where they feel comfortable and healthy. To provide quality service in an oral and dental health clinic, attention should be paid to physical environmental factors and spatial and technical features, and the sense of comfort of the patients, dentists, and staff should taken into consideration.

AĞIZ VE DİŞ SAĞLIĞI POLİKLİNİKLERİNİN ERGONOMİK TASARIM FAKTÖRLERİ AÇISINDAN DEĞERLENDİRİLMESİ

Anahtar Kelimeler

Ergonomi
Diş polikliniği
Mekansal konfor
Görsel ve işitsel konfor
Termal konfor

Öz

Ağız ve diş sağlığı kliniklerinin konfor koşulları fiziksel çevre faktörlerine bağlıdır. Hasta, hekim ve personelin memnuniyeti ortamın ergonomik koşullarının uygunluğu ile doğru orantılıdır. Fiziksel faktörler gün boyu çalışan hekimler ile personelin sağlığını ve performansını etkilerken, kliniklerin mekânsal ve teknik organizasyonu ise hasta sağlığı ve konforu için oldukça önemli olmaktadır. Diş hekimlerinin, personelin ve hastaların klinik uygulamalar sırasında maruz kaldıkları fiziksel risk faktörlerini mimari disiplin açısından ele alan yeterli çalışmaya rastlanmamıştır. Çalışmanın amacı, ağız ve diş sağlığı polikliniğinde diş hekimi, personel ve hastaların ergonomik konfor koşullarını ortaya koymaktır. Araştırma yöntemi, İstanbul'da bir ağız ve diş sağlığı polikliniğinde gerçekleştirilen saha çalışmasıdır. Araştırma tekniği, "yerinde gözlem", "ölçme", "anket" ve "görüşme"dir. Mekânın ışık, ses ve sıcaklık değerlerinin ölçülmesinde "Lüks Işık Ölçer", "Ses Ölçer" ve "Termometre" uygulamaları kullanılmıştır. Hastalara, hekimlere ve personele Likert Ölçekleme Modeli ile anket uygulanmıştır. Sonuç olarak, hastalar kendilerini rahat hissettikleri polikliniklerde tedavi olmayı tercih etmekte, diş hekimi ve personeli kendilerini konforlu ve sağlıklı hissettikleri ortamlarda daha motive ve verimli çalışabilmektedir. Bir ağız ve diş sağlığı polikliniğinde kaliteli hizmet sunabilmek için fiziksel çevre faktörlerine, mekânsal ve teknik özelliklere dikkat edilmeli; hasta, diş hekimi ve personelin konfor duygusu önemsenmelidir.

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1. Introduction

Spatial, visual, auditory and thermal comfort conditions for outpatient clinics affect patient, dentist and staff satisfaction. Light, noise, ventilation, temperature, humidity and air flow are physical risk factors for both patients and staff in outpatient clinics. Ultrasonic devices such as motor-operated tools, ultrasonic cleaner, suction system equipment, compressor and laser are important factors affecting both physiological health and mental activities of physicians and staff. Spatial organization and design of equipment is an important issue also in terms of patient ergonomics. In oral and dental health polyclinics, the comfort of patients, physicians and staff should be considered, especially in places such as examination rooms, resting areas and toilets. It has been determined that there are not enough studies in the architectural literature regarding both the spatial comfort of dentists, staff and patients, and the physical risk factors they are exposed to during clinical practices. For this reason, it has been deemed necessary to examine the ergonomic conditions of oral and dental health polyclinics in terms of dentists, staff and patients. The study aims to reveal the physical risk factors affecting physicians and staff in oral and dental health outpatient clinics, and to determine appropriate spatial comfort conditions for physicians, staff and patients. In the second part of the study, there is literature on the importance of ergonomics in oral and dental health clinics for dentists, staff and patients; in the third part, the method of the study is explained; the fourth and fifth chapters contain the case study analysis and the results of the research; The last section ends with discussion and conclusions.

2. Literature Review

2.1. The Importance of Ergonomics for The Dentists and Staff in Oral and Dental Health Polyclinics

Consulting rooms, clinics, and hospitals are various institutions where oral and dental health treatments are administered. Basic dental care takes place in a study room with the dentist, assistant, and patient. Therefore, dentist's and staff's requests and interrelations in the workroom are important issues to be considered. Another featured matter is that machine tools used in workrooms are environments where machines and people are intertwined (Khalil, 1974). Several types of ergonomic risk factors arise in dentistry practices. These include work-related risk factors, posture-related risk factors, equipment-related risk factors, environmental risk factors, and psychosocial risk factors (Kırzıoğlu & Yetiş). Both managers and employees must know all the physical, social, and psychological factors that affect the ability and productivity of a worker (Özok and Aytaç, 2010). Factors that have noticeable effects on employees in businesses are the brightness, temperature, width, ventilation system of the environment, colors, furniture placements, etc. (Güney, 1995).

2.1.1. Spatial Comfort for The Dentist and Staff

Dentists perform their clinical practices in the form of four-handed dentistry by sitting in the physician's chair with an assistant. Dentistry is a profession with high physical activity due to the work had been practiced. It is seen that there are many ergonomic complaints due to both sitting and standing working. The physician's chair where dentist spent a lot of time should be designed in a way to facilitate movement and reaching the patient. Owing to the fact that a single size is not ideal for all physicians, the chair needs to be planned to fit the physician's body measurements (Gupta, 2011). The physician's chair should have a stable (5 footed, wheeled), adjustable body and seamless upholstery and provide ergonomic features, including optional arm rest. In addition to this, dental unit is another important ergonomic factor for the dentist and staff. The dental unit should have additional forearm / wrist support, the head support should be small and the back support should be narrow (Karacaer et al., 1995; Valachi and Valachi, 2003). In a study by Norris, back pain was detected in 1/2 of the dentists examined (Norris, 1977). Shugars (1984) said that regular exercise (5-7 minutes daily), which is specially prepared for dentists, increases the resistance of physicians. Goidlist (1979) claims that at dentists who do not wear glasses, scars caused by objects which scratch eyes can become inflamed and these inflammations cause retinal tears and glaucoma (eye pressure). But today, the use of protective glasses and face shields is very common. Especially during the current pandemic period, the use of masks, protective glasses and face shields within the scope of Covid 19 measures has been made mandatory in the information document prepared by the Scientific Committee of the Turkish Dental Association (http://www.tdb.org.tr/).

2.1.2. Visual Comfort for The Dentist and Staff

Employees working in optimal lighting conditions ensure their eye health and visual clarity (Akyuz et al., 2010). For special applications that require attention, it is necessary to use localized work lighting. This prevents shadows and reflections on the work surface. (Carpman and Grant, 1993). In certain activities such as visual inspection, 750-5000 Lux lighting levels are used for being able to distinguish fine details (Dul and Weerdmeester, 2007). Lighting should be sufficient for dentists and their team to work efficiently because of working in a small and low light environment such as mouth.

Insufficient light would be an obstacle to see the surface of the teeth clearly. Therefore, dentists work with reflectors, which are orientable and strong light sources. With the developing technology, LED-based lights are preferred in dentistry. Surgical reflectors/dental lights have generally 3000 lux illumination power. Lack of lighting can decrease the performance of the dentist by causing eye fatigue and also poses a risk to the patient (Başak, 2018). Insufficient lighting in the environment and inadequate working light cause eye fatigue and insufficient lighting conditions affect the dentist and staff psychologically. Hence working becomes difficult and efficiency decreases.

2.1.3. Auditory Comfort for The Dentist and Staff

Noise and vibration coming from hand-held motor operated tools and devices have very serious negative effects on the performance of both dentists and assistive team. These effects are hearing loss, muscle strain, stress, increased blood pressure, change of heart rate and blood circulation rate, pupil enlargement, nervous exhaustion, fear, tiredness and slowing mental functioning. In a study, dental education environments were examined, and the high noise levels generated by the equipment and equipment used were determined as 92.2 dB(A) and 96 dB(A) (Qsaibati and Ibrahim, 2014). In the Noise Regulation published in the 28721 numbered Official Journal, the lowest exposure activity value is 80 dB(A). The highest exposure action value is 85 dB (A) and the exposure limit value is 87 dB (A). Besides, the daily noise exposure level should not exceed 87 dB (A) (Regulation on the Protection of Employees from Noise-Related Risks, 2013). According to a study by Poole et al. (2008) the vibration spectra of the handheld devices used in dentistry have been detected to contain strong vibrations at high frequencies. According to the Vibration Regulation published in the 28743 numbered Official Journal, hand-arm vibration daily exposure limit value for an eight-hour working period is determined as 5 m/s2 and daily exposure action value is determined 2.5 m/s2 (Regulation on the Protection of Employees from Vibration Related Risks, 2013).

It is known that when workplace noise is reduced, the difficulty of the work decreases, productivity increases, and also work accidents decrease (Ekinci, 2006). High-frequency vibrations affect both the physiological health and mental activities of the employees. The continuity of the vibration tires the employees, makes them nervous, and causes mistakes and accidents (Camkurt, 2007; Başak, 2017). The vibrating devices used by dentists can cause an occupational illness called hand-arm vibration syndrome as well as Raynaud Syndrome is seen commonly among dentists and their staff working with intensive vibrating hand tools (Şenel, 2007).

2.1.4. Thermal Comfort for The Dentist and Staff

The temperature of the human body is constant between 36.5-37 degrees. This is achieved by the heat exchange between the body and the environment (https://prosafety.com.tr). "The thermal comfort, physical and mental functions of a working individual are affected by even minor changes in body temperature. Cold, chills, reflex insufficiency, decreased sensitivity of touch weaken dexterity in a cold working environment. This temperature is the temperature at which the person feels physiologically comfortable; it is not the temperature measured with a dry thermometer" (Başak, 2018). In dental health polyclinics, air, temperature, humidity are the physical risk factors that the dentist and staff are exposed to. For instance, the temperature of the environment may cause thirst, mineral deficiency, tiredness, drowsiness, disorder in psychomotor ability, heat stroke and fainting (İncir, 2008). Thus, it is necessary to remove the harmful or bad smell arising from the materials used in the dental clinics and to provide sufficient fresh air.

2.2. The Importance of Ergonomics for The Patients in Oral and Dental Health Polyclinics

The basic and main design rule in architecture is to think and solve problems accordingly in a measure order based on function and human dimensions. Ergonomic dimensions in the design provide the patients positive thoughts that they will feel safe, healthy, comfortable and away from stress (Güller, 2007). It is very significant that the polyclinic is clean and airy from the point of psychology of the users. After entering the dental health polyclinic, it is necessary to be inviting, sensitive and caring for the patient and relieve them from stress. In order for users to feel comfortable and safe, attention should be paid to the features of waiting room, halls and corridors like color, sound, smell, material, and the selection of outfit elements should be made correctly. Besides art objects and live or artificial plants will contribute to the polyclinic space if used properly.

2.2.1. Spatial Comfort for the Patients

The perception of the space which includes all physical, social and psychological factors from the perspective of the patient determines the ergonomic value and comfort of the polyclinic (Dönmez, 2008). The most important factor in the oral and dental health polyclinic is the creation of the spaces by taking into account the patient's body dimensions and comfort conditions. There are 2 important elements for the patients in polyclinics: waiting area and dental unit. These special comfort conditions determine patients' satisfaction. Dental unit to ensure the patient's comfort conditions: it must be suitable for the patient's entry and exit, must have

swivel or pull-down arm supports, the head restraint must be adjustable, hands can move freely and the seat height must be adjustable (Karacaer et al., 1995; Valachi & Valachi, 2003). To that, the seat groups in the waiting areas are the elements that provide spatial comfort for the patient. According to Erkan (2005), the seats used for rest should have a minimum depth of 45 cm. The waist and back should be supported to keep the body comfortable and upright.

2.2.2. Visual Comfort for the Patient

The visual comfort of the human is possible with a correct lighting design that responds to the physiological and psychological needs of the users. International standards must be provided for a correct lighting design in terms of visual comfort (Şener & Yener, 2013). It is very important to have a good lighting system in oral and dental health polyclinics, especially in examination rooms. The intensity of the lighting used should be sufficient and spread over an equal area. The direction of light is also important to keep the patient's comfort level high. According to Dul and Weerdmeester (2007), light intensity between 20-200 Lux is sufficient for general activities. For places where visual detailed activities are more important and waiting rooms, light intensity of 200-750 Lux is required. On the other hand, to utilize from daylight - natural lighting, window surfaces should be larger than 1/3 of the floor surface. While windows near the ceiling get a lot of daylight, skylights get twice as much daylight than wall windows. Painting the ceilings in white or light colors significantly increases the daylight in the space (İncir, 2008). Color selection should be made according to the type of work to be performed in the space and the color scheme should be adapted to physiological and psychological needs. In a monotonous work, stimulating colors should be used to separate several parts, and large surfaces should not be painted in bright colors. While the effects of distant colors blue and green are soothing, red, orange, yellow and brown colors are warm colors and provoke psychic states (Grandjean, 1975). In tasks that require a lot of attention, such as dental treatment, the color scheme should be temperate to prevent absent-mindedness. That's why walls, ceilings and other parts should be painted in pastel color tones. Stronger colors can be used for less-used places such as halls, corridors, public areas.

2.2.3. Auditory Comfort for the Patient

Patients coming to the polyclinic for dental treatment are exposed to the noise created by the dental tools used by dentists, ultrasonic cleaners and devices in the dental laboratory. Continuous noise levels disturb patients. In these environments, the noise level should be below 80 dB(A). Erkan (2005) states that a monotonous and very quiet environment creates drowsiness and noise level that would not cause health problems is a kind of alertness factor. To reduce the transmission of noise between the noise source and the receiver, the spatial organization between the waiting rooms and examination rooms containing noisy activities should be well organized. Folding screens between the noise source and the people can reduce the noise level. Plus, ceilings are often used to absorb sound in noisy places. Ceilings protect against disturbing effects such as echo in reducing the noise level (Dul and Weerdmeester, 2007).

2.2.4. Thermal Comfort for the Patient

It is necessary to ventilate a workplace to meet the need for coolness and fresh air, to dissipate the heat emitted by working machines and people, to alleviate air pollution (Hayta, 2016). It is desirable that the airflow rate is not high, the temperature is at room temperature, and at a certain level of humidity, either natura lor artificial ventilation is used. According to Erkan (1988), researches have shown that the preferred ambient temperature of those working in the office and those doing light physical work is between 19.4 °C and 22.8 °C. In terms of ergonomics, the humidity level is as important as the temperature of the environment. In general, it is preferred that the relative humidity does not exceed 70%. More than 70% relative humidity indicates moist air, and less than 30% relative humidity indicates dry air. It is possible to make such environments more suitable by using air conditioners and ventilators, and in environments with low humidity levels, with air conditioners. Also, a suitable air flow should be provided for thermal comfort in the environment. Ambient temperature and humidity level should be taken into consideration while creating the air flow. The ideal air flow is around 0.15 m/s. If the air movement rises above 0.51 m/s, the working environment is considered airy. Environments where air flow is below 0.1 m/s are considered airless. Such environments are disturbing and need to be ventilated frequently (Su, 2001). In the oral and dental health polyclinics, climate comfort means that the air is not too cold or too hot, and the humidity and air flow are not at uncomfortable level.

3. Methodology

The method of the research is fieldwork, which is one of the methods that Groat and Wang set in their book "Research Methods in Architecture" (2002). On-site observation, measurement, and survey techniques, which are frequently used in environmental behavior research, were preferred as research techniques. In this study aiming to evaluate the comfort conditions of patients, dentists, and staff in the oral and dental health polyclinic, an Oral and

Dental Health Clinic in Istanbul, Tuzla was chosen as the case area. In the study, two different groups, namely the patient and the personnel (the dentists and their team), were surveyed. The participants' information was kept confidential by research ethics, and ethics committee approval was obtained. A questionnaire of 20 questions was prepared to measure the spatial, visual, auditory, and thermal comfort levels of the patients who applied to the dental health outpatient clinic. The survey was conducted on different days and times in November 2023 with 29 female and 26 male participants. On the other hand, a different questionnaire consisting of 26 questions was administered to 10 personnel working in the polyclinic, including dentists, to learn about their comfort conditions. The Likert Scaling Model with a five-level approval response category was used while preparing the questionnaires. The questionnaires made to the two groups are given in Annex 1 and Annex 2.

4. Evaluation of The Oral and Dental Health Polyclinic

The design of the oral and dental health polyclinics includes many regulations and technical requirements. In this context, the Oral and Dental Health Clinic, which is selected as a case study area, is an A type polyclinic. According to the regulation published by the Ministry of Health in the Official Journal, this type polyclinic is the health institution, which can be opened and operated jointly by at least two dentists and its service units created in a direct connection, with the minimum requirements determined by the "Regulation on Private Health Institutions Providing Oral and Dental Health Services" (2022).

The spatial organization of the Oral and Dental Health Polyclinic is given in Figure 1. The polyclinic consists of 2 floors, each floor is 260 m2.

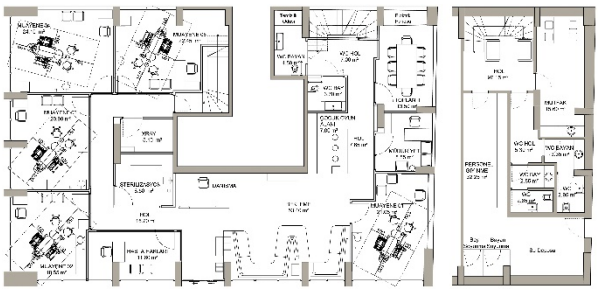

Figure 1. Ground and Basement Floor (Adapted from ND Architecture Drawings).

On the ground floor, there are an information desk, waiting room, children's playground, management/accounting, patient rights room, 5 examination rooms, sterilization room, x-ray room, meeting room, male and female restrooms. On the basement floor, there are a staff dressing room (2 locker cabin), 1 male and 1 female staff WC, kitchen, resting area, water tank and mechanical room. The area size distributions of the spaces are given in Table 1.

Table 1: Ground and Basement Floor Area Distributions

Ground floor	m2	Basement floor plan	m2
Waiting room	50	Kitchen	15.60
Children's Playroom	7	Resting room	10
Dentist room -1	21	Staff dressing room	32.25
Dentist room -2	18.50	Staff wc 1	6.30
Dentist room -3	20	Staff wc 2	5.50
Dentist room -4	24	Hall	5.30
Dentist room -5	22	Water tank	12.20
Sterilization Chamber	8.50	Mechanical room	95.00
Xray room	5		
Patient rights room	10		
Principal's office	8.50		
Meeting room	14		
Male wc	3.70		
Women wc	4.50		
Storage room	1.50		
Circulation areas	30		

4.1. Evaluation of Spatial Comfort and Design Elements

Information Desk: The table dimension of the information desk is 90x225 cm (Figure 2). Every detail has been considered for those who work at the information desk, practical areas have been created behind the counter and by that a comfortable working environment has been created.

Figure 2. View From Entrance and Counter

Catering Module: The catering module with dimensions of 90x170 cm in the waiting area has

been designed taking into account the patients' access distance (Figure 3).

Figure 3. View of the Catering Module

Waiting Room: There are 2 separate seating units in the 50 m2 waiting area. Sitting groups similar to cedar are designed 45 cm high from the ground and 57 cm deep. While the cushion width of the leaning part of the cedar is 10 cm at the beginning, it becomes 18 cm as it approaches the waist. In the back of the cedar, 24 cm wide artificial flower bed adds color and harmony to the environment. There is a 35 cm wide magazine area in the middle of the two cedars (Figure 4).

Figure 4. View of the Seat Area

Children's Playground: The playground in the waiting area consists of a children's play table, stool and wardrobe. The table is 65 cm from the ground and table length is 200 cm. The stool is covered with a 60mm cushion and its height from the ground is 35 cm (Figure 5).

Figure 5. View of the Children's Play Area

Dental Unit: Around the dental unit in the examination room, one and a half meters on the patient's side and 1 meter on the three sides are left for facilitating the work of the dentist. These measures meet the minimum requirements set by the "Regulation on Private Health Institutions Providing Oral and Dental Health Services" (6 October 2022). For dentists, the cables are located away from their working space. The working area order can be adjusted for different practitioners. Issues such as working distance, depth of field, and angle of declination are carefully adjusted. For patients, the dental unit has space for entry and exit, and swivel or swing-down arm supports, seat height and slope can be adjusted. It can move hands free (Figure 6).

Figure 6. View of the Dental Unit

Clinical Cabinet: Clinic cabinet has 211 cm width and 90 cm height (Figure 7). Wardrobe starts after 30 cm base which is necessary for being able to clean floors properly. Cabinet storage areas consist of drawers and sink. It is in a place easily accessible by physicians and staff.

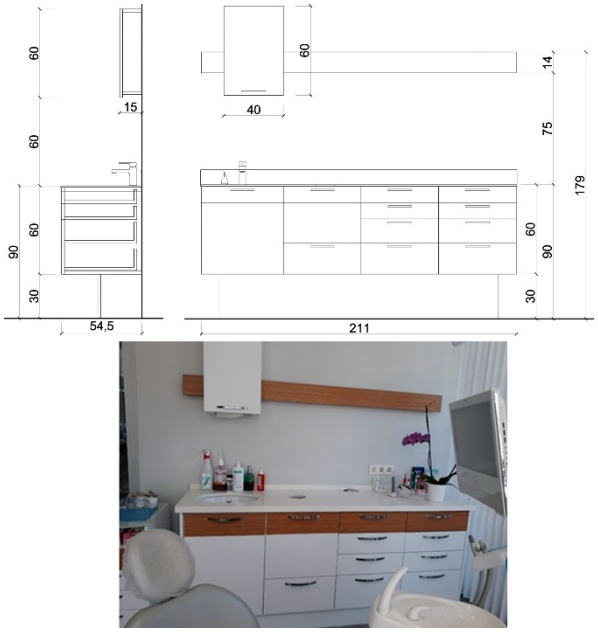

Figure 7. View of the Clinical Cabinet

Caisson Dimensions: In the caisson next to the dentist, tools such as medicine are kept. 50 cm wide, 77 cm high caisson is located in the room of every dentist. Hand tools are within 20 cm of the dentist's field of vision (Figure 8).

Figure 8. View of Caisson

Dentist's Working Table: The dentist's table measures 74x160 cm. The physicians have separate drawers where they can put their personal belongings and documents. Movement area height of the feet under the table is 41 cm (Figure 9).

Figure 9. View of the Dentist's Working Table

Sterilization Room: The sterilization room has 2 counters with a width of 283 cm and 215 cm. There is one sink in the counter. Under-counter cabinets are 90 cm high from the floor. There are only X-ray devices in the X-ray room (Figure 10).

Figure 10. Views From the Sterilization Room, X-Ray Room and Corridor

Patient Rights Room and Management Room: Study tables with dimensions of 74×110 cm was used in patient rights and management rooms (Figure 11). There is an 8-person meeting table measuring 110×235 cm in the meeting room located right next to the management.

Figure 11. Views From the Patient Rights Room and The Management Room

Wet Areas: There are male and female wc designed accessible by the disabled. WC doors open outwards. Door widths are 120 cm. 30 cm of the door is opened practically for disabled car use. Toilet seats are designed appropriately for disabled use. The 135 cm wide sink is mounted at 74 cm height on the floor. There is a 1.5 m2 cleaning cabinet in the female WC. This area is separated by a door. There are signboards on the doors of all rooms and units that tell the purpose of the rooms (Figure 12).

Figure 12. Views From the Wet Areas

Staff Areas: Staff locker room is in the basement and it has 2 changing rooms and 10 cabinets. Cabinets are 60 cm deep and 225 cm high. Cabinets which have 609 cm length are designed for the personal belongings of the staff. The resting room was not reserved as a separate space, the area under the stairs was evaluated for this purpose (Figure 13). There is no natural lighting and natural ventilation in the resting area. Therefore, it is an insufficient area in terms of comfort conditions. There are male and female WC in the basement of the building and adjusted for the number of employees (Figure 14).

Figure 13. Staff Room and Rest Area Views

Figure 14. Personnel Area Wc Views

The kitchen on the basement floor has a 235 cm long and 85 cm high counter. It is 5cm smaller than the minimum required distance for two people to work together. There is a dining table for 4 people in the kitchen (Figure 15). The height of the table from the floor is 74-75 cm. In the 15 m2 dining hall area, 4 people can eat at the same time and the table provides minimum dimensions (Figure 16). The chairs are 44 cm high, 45 cm wide and 40 cm deep.

Figure 15. Views of Kitchen

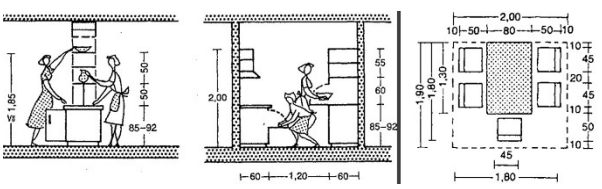

Figure 16. Minimum Motion Measurements in The Kitchen (Neufert, 2000)

4.2. Evaluation of Visual Comfort

The facade of The Oral and Dental Health Clinic is the aluminum glass joinery. Jalousie was used in the glasses to prevent direct light to the eyes of the patient, dentist and staff. The polyclinic mostly benefits from natural lighting. Window heights are 272 cm. As artificial lighting, 60×60 LED lighting is used in suspended ceilings. Lighting measurements of the polyclinic were calculated by taking the average at different times of the day with the Light Meter application. Measurements were made at a height of 1 meter from the ground. Measurements were made from 4 different points on each working area. While determining these points, "different lighting values in the environment" were included in the measurements. Measurement; It was determined by the average of 4 different points starting slightly below the lighting source and going towards the darkest point. While determining the points, the distances between the points were chosen equally. Care has been taken to ensure that these distances are not more than 3 meters. The light quantity values of each space are shown in Table 2. The standard values given in Table 2 (except the dentist room) are the standard values for generalized environments. When the measurements were examined according to the limit values given in TS EN 12464-1 (indoor) standards, it was found to be visually comfortable.

Table 2: Visual Comfort in Different Places of Oral and Dental Health Polyclinic

No.	Location	Lux	Standard value (Lux)
1	Waiting Room	801	200-750
2	Children's Playroom	419	200-750
3	Dentist Room	3490	3000
4	Meeting Room	325	200-750
5	Staff Resting Room	125	20-200
6	Kitchen	125	20-200

Otherwise, light shades are dominant in the polyclinic. While the cushion parts of the seats are purple in the waiting room, there are paintings in blue tones on the walls. White and light gray colors are used on the walls. The harmony of the white lacquer with the wood-tone coating material used in the furniture gives the room a pleasant appearance. In the examination rooms, dental units are selected in red, purple and orange colors. The dental clinic has sufficient spatial equipment. Color, texture, material selections were made correctly. The space receives a

lot of daylight and has a good lighting system (Fig. 17). The intensity and direction of the lighting used to keep the patient's comfort level high is in the right direction.

Figure 17. Front View of the Oral and Dental Health Polyclinic in Istanbul Tuzla

4.3. Evaluation of Acoustic Comfort

The noise level in the polyclinic was measured with the Sound Meter application between the hours of 15:00 and 16:00 when the street where the outpatient clinic is located is the busiest. Measured noise levels are in Table 3. It has been determined that the acoustic values of the spaces are in the standard value range.

Table 3: Acoustic Comfort of Spaces

Location	When people are not in space (dB)	When people are in space (dB)	Standard value (dB)
Waiting Room	58.99	62.20	Min 30-Max 80
Dentist Room	70.37	81.01	Min 80-Max 85
Meeting Room	68.25	varies according to the number of people	Min 30-Max 80
Staff Dressing Room	71.54	the compressor device of the dental units is located in an area passed through the dressing room	Min 30-Max 80
Kitchen	70.00	-	Min 30-Max 80

4.4. Evaluation of Thermal Comfort

High temperature in the outpatient clinic may cause discomfort such as heat stroke, low blood pressure, dizziness, decreased body resistance, excessive sweating, depressed mood, and anxiety in the patient, physician and staff. In this case, thermal comfort is an important criterion. When the temperature value of the place is at the optimum value, the thermal comfort level would be provided. In situ measurements, the ambient temperature of the polyclinic was 20 ° C and found normal. Necessary air flow is provided by many windows in the polyclinic.

5. Results

Results of the survey study in terms of patients, physicians and staff are included in the subheadings of this section.

5.1. Results in Terms of Patients

Personal characteristics of 55 participants, 28 women and 27 men, are given in Table 4. Eight of the participants are between the ages of 18-25, 15 of them 26-35, 19 of them 36-45, 8 of them 46-55 years old, 5 of them are over 55 years old. Education levels of the respondents: 4 received primary school, 22 high school, 23 undergraduate and 6 graduate. Participants were asked to make a five-level assessment of the questions as very good, good, medium, bad and very bad.

Table 4: Gender, Age Range and Educational Background of The Participants

	Age ranges of the participants					Education Status			
Number of People (55)	18-25	26-35	36-45	46-55	55 and over	Primary School	High School	License	Master Degree
	8	15	19	8	5	4	22	23	6

Comfort evaluations of the waiting room and examination room are given in table 5. The evaluations that are not in the table are as follows: 79.6% of the participants found the outpatient clinic entrance “very good” in terms of disabled access. The participants evaluated the toilet space as 'very good' at a rate of 85.5%. Colors in the space were rated as 'bad' at a rate of only 1.8%. In general, the outpatient space was found positive in terms of ergonomic comfort conditions.

Table 5: Comfort Evaluations of Participants for Waiting and Examination Rooms

	Waiting Area	Examination Room
General Evaluation	81.8% very good (Seat Group: 69.1% very good, Play Area: 48.1% very good, 1.9% very bad)	90.9% very good (evaluation of distance). Comfort of the examination room 92.7%. Comfort of the dental unit 89.1% very good
Natural Lighting	89.1% very good	90.9% very good
Artificial Lighting	78.2% very good, 3.6% bad	78.2% very good
Ventilation	70.9% very good, 1.8% very bad	83.6% very good
Heating	78.2% very good	90.9% very good
Noise Level	87% very good	89.1% very good

5.2. Results in Terms of Personnel

Personal characteristics of the personnel are given in Table 6. 5 dentists and 5 staff work in the polyclinic. 6 out of 10 employees are between the ages of 26-35 and 4 between the ages of 36-45. There are no employees over the age of 39. The education level of the employees is as follows; 1 primary school graduate, 4 high school graduates, 3 undergraduate graduates, 2 postgraduate graduates. The personnels were asked to make a five-level assessment of the questions as very good, good, medium, bad and very bad.

Table 6: Profession, Gender, Age Range and Educational Status of The Personnels

Characteristics of the Personnel	Profession of Staff		Gender status of the staff		Age ranges of the participants		Education Status			
Number of the Personnel (total 10 person)	Dentist	Staff Work	Women	Man	26-35	36-45	Primary School	High School	License	Master Degree
	5	5	9	1	6	4	1	4	3	2

Transportation to the polyclinic was found to be “very good” by 90%. The adequacy of the resting area is “very good” with 80%, the comfort of the seats in this area was found to be “very good” by 60%. At resting area: by 80% natural lighting, artificial lighting by 60% were found “very good”, and for ventilation “bad” evolution by 10% were noticeable. It is remarkable that the ventilation of the rest area is 10% 'bad'. Because this area remains under the stairs and does not benefit from natural lighting and natural ventilation in any way. Employees' comments about heating of the resting area were “good” by %50. It has been tested that the resting area is not exposed to too much noise. It was determined that the majority (90%) of the personal were satisfied about cabinets in staff locker room. The comfort of the changing rooms was found “bad” by 10%. The resting rooms were precepted comfortable by 90%. While dining hall’s natural lighting was found as 50% “very bad”, artificial lighting was expressed “good” by 50%. Despite the smell of food in the dining hall, the ventilation of the place was evaluated as 20% “bad” and 50% “good”. The noise level of the dining hall has a normal value and its heating evaluated 70% “good”. Access to the examination room and working comfort of the dental unit were found to be “very good” by 70%. The natural and artificial lighting of the examination room was determined as “very good” by 90%. The ventilation of the examination room was evaluated as “good” by 50% and its heating by 60%. The ventilation of the examination room was evaluated as “good” at the rate of 50% and the heating as “very good” at the rate of 60%. In terms of employees, the working comfort of the room was 80% “very good”. The colors used in the interior are 80% liked by the employees. The general circulation was expressed as “very good” by 80%. The comfort assessment for some of the places is given in Table 7.

Table 7: Comfort Evaluations of Staff for Resting Area, Dining Room and Examination Rooms

	Resting Area	Dining Hall	Examination Room
General Evaluation	Adequacy of the resting area: 80% very good, the comfort of the seats: 60% very good		Access to the examination room and comfort of the dental unit: 70% very good
Natural Lighting	80% very good	50% very bad	90% very good

Artificial Lighting	60%very good, 10% middle	50% good	90% very good
Ventilation	40% very good, %10 bad	50% good, 20% bad	50% good
Heating	50% good, 10% bad	70% good	60% very good
Noise Level	80% very good, 10% bad	80% very good	70% very good

During interviews with 5 Dentists in the polyclinic, it is noted that inflamed foot wounds, tendon shortening, undeveloped toe nails and flatfoot were common complaints. In the interview, dentists stated that their left ears are more affected by noise than their right ears. The reason for this was reported to be the noise of the saliva absorbing system on the left side of the dental unit in dentists using the right hand. In addition, physicians experience health problems such as headache, loss of appetite, fatigue, mouth sores, gingivitis due to the contents of the materials used. These situations occur by inhaling or directly handling the mercury used in amalgams (Mıhçıoğlu, 1991). For this reason, dentists have to take precautions by using masks, gloves and protective glasses to protect both these health problems and infectious diseases such as Hepatitis, AIDS and Herpes.

6. Conclusion and Discussion

In this research, the ergonomic design of the Oral and Dental Health Clinic in Istanbul-Tuzla was evaluated in terms of physicians, staff, and patients by considering the spatial, visual, auditory, and thermal comfort conditions. According to the study results in general, patients found the polyclinic comfortable. However, it was found that the artificial lighting of the waiting room, examination rooms, and the children's playground could be in better condition. When we look at the comfort assessment in terms of dentists and staff, it is seen that they find the place very positive. It has observed that the staff works friendly, happy and highly motivated. The staff ignored the lack of comfort in the rest area and kitchen and did not find it disturbing. It was thought that this is because the personnel are in a peaceful environment and the business has an understanding and positive attitude towards the employees.

Comfort conditions in oral and dental health polyclinics are fairly significant for dentists, staff, and patients. The comfort of the polyclinic space is associated with physical environmental factors. All elements utilized within the dental health polyclinic, along with all technical features facilitating spatial, auditory, visual, and thermal comfort conditions, should engender feelings of safety, health, comfort, and stress-free experience for the patient. Patients choose to be treated at the dental clinic where they feel comfortable. In addition, the consistency of ergonomic dimensions in space design is an important issue for dentists and their staff. Dentists and their teams can work more motivated and efficiently in environments where they feel comfortable and healthy. The working environment should be free from problems such as temperature, noise, humidity, dust, ventilation and lighting. Spatial elements should be placed in a way that does not harm the human body and organs while working. Dentists' non-ergonomic work habits can lead to musculoskeletal disorders due to prolonged periods of sitting or bending. Improving the work environment through proper body positioning, regular breaks, using ergonomic equipment, and ergonomic space design is crucial. These measures can help dentists maintain a healthy work life.

To sum up, the working environment should be created according to ergonomic conditions for employees. The efficiency and quality of the work done depends on whether the employee is happy or unhappy in their environment. In this context, patient, physician, and staff satisfaction are directly related to the convenience of the ergonomic conditions of the working environment. For an oral and dental health clinic to provide good and high-quality service, it is necessary for the spaces to be functional and the organization of the spaces to be done correctly. Technical equipment such as lighting, sound, and ventilation must be created following the regulations.

Conflict of Interest

No conflict of interest has been declared by the authors.

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Appendix 1

EVALUATION QUESTIONNAIRE FOR ISTANBUL-TUZLA ORAL AND DENTAL HEALTH POLYCLINIC DENTIST AND STAFF

AGE	
GENDER	
EDUCATIONAL STATUS	
QUESTIONS	
1	Could you evaluate the access to the polyclinic?
2	Could you evaluate the sufficiency of the resting area?
3	Could you evaluate the comfort of the sofa group in the resting area?
4	Could you evaluate the natural lighting in the resting area?
5	Could you evaluate the artificial lighting in the resting area?
6	Could you evaluate the ventilation of the resting area?
7	Could you evaluate the heating of the resting area?
8	Could you evaluate the noise level of the resting area?
9	Could you evaluate the personal lockers in the dressing room?
10	Could you evaluate the comfort of the cabin in the dressing room?
11	Could you evaluate the WC areas?
12	Could you evaluate the natural lighting in the dining hall?
13	Could you evaluate the artificial lighting in the dining hall?
14	Could you evaluate the ventilation of the dining hall?
15	Could you evaluate the heating of the dining hall?
16	Could you evaluate the noise level of the dining hall?
17	Could you evaluate the access distance to the examination room?
18	Could you evaluate the comfort of the working area of the dental unit in the examination room?
19	Could you evaluate the natural lighting in the examination room?
20	Could you evaluate the artificial lighting in the examination room?
21	Could you evaluate the ventilation in the examination room?
22	Could you evaluate the heating in the examination room?
23	Could you evaluate the noise level in the examination room?
24	Could you evaluate the working comfort of the examination room?
25	Could you evaluate the color choices used in the interior?
26	Could you evaluate the general circulation?

Appendix 2

ORAL AND DENTAL HEALTH POLYCLINIC IN ISTANBUL-TUZLA EVALUATION SURVEY

AGE	
GENDER	
EDUCATIONAL STATUS	
QUESTIONS	
1	Could you evaluate the entrance of the polyclinic in terms of the use of the disabled?
2	Could you evaluate the waiting area?
3	Could you evaluate the comfort of the sofa group in the waiting area?
4	Could you evaluate the natural lighting in the waiting area?
5	Could you evaluate the artificial lighting in the waiting area?
6	Could you evaluate the ventilation in the waiting area?
7	Could you evaluate the heating in the waiting area?
8	Could you evaluate the noise level in the waiting area?
9	Could you evaluate the children's playground in the waiting area?
10	Could you evaluate the access distance to the examination room?
11	Could you evaluate the comfort of the dental unit in the examination room?
12	Could you evaluate the natural lighting in the examination room?
13	Could you evaluate the artificial lighting in the examination room?
14	Could you evaluate the ventilation in the examination room?
15	Could you evaluate the heating in the examination room?
16	Could you evaluate the noise level in the examination room?

17	Could you evaluate the comfort of the examination room?
18	Could you evaluate the WC areas in the polyclinic?
19	Could you evaluate the color choices used in the interior?
20	Could you evaluate the general circulation?