

The Dental Oasis

Reem Azab

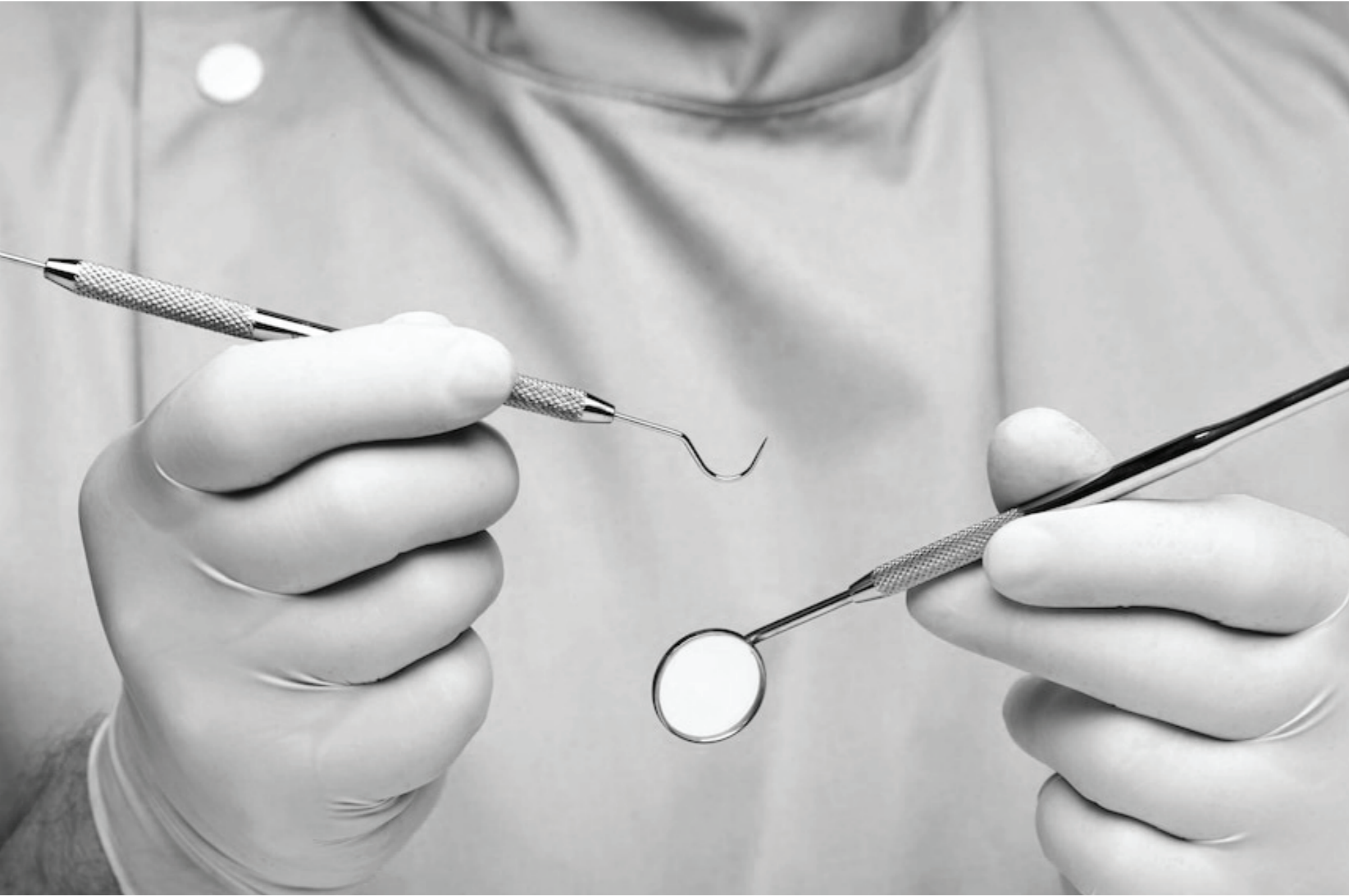
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Abstract

Dental anxiety is an extreme fear of any procedure involving the teeth, which leads to the probability of postponing or procrastinating to any type of dental surgery, whether minor or even if it is just to promote oral health. This causes the inroads of disease to have a negative effect on the whole dental process. Approximately 36% of the UK population is estimated to be affected by this type of fear, and a further 12% suffer from an extreme version of it. ¹

When the relationship between dental cavities and dental anxiety was assessed in 275 children, by Oba and Sonmez in one of the the pediatric dental hospitals in Turkey, it was reported that there was a direct correlation between the increase of cavities and the increase of dental anxiety, which clearly shows how important it is to address dental anxiety in children before it causes negative oral health issues. Also, in a survey of 1,420 adult participants, the age of inception of dental anxiety was studied. The results showed that 16.4% of them suffer from dental anxiety, half of whom reported being dentally anxious as children, further highlighting the importance of dealing with the anxiety at an early age. ²

Studies suggest that the dentist should recognize all factors, both inside and outside of the typical dental setting, which might contribute to dental anxiety, so they are better enabled to select the most suitable behavior management interventions, whether non-pharmacological or pharmacological, to minimize dental anxiety, and deliver dentistry of the highest quality, while also aiding the development of a healthy attitude towards dental health and treatment. ³

Since the environment can have a substantial influence on how healthcare is experienced by patients ⁴, the proposal is to assess the current interior design norms in multiple dental clinics, then utilize the non-pharmacological intervention methodology through the introduction of new interior design aspects, which in turn should create a better experience for children during their dental visits, in hope of diminishing their dental anxiety. The target group of the study are both children and adults, with ages ranging between 5 and 65 years of age, who live in Doha, Qatar.

Rationale

Dental Anxiety is the fear associated with visiting the dentist whether that visit is for preventive care or getting a procedure done. It is considered to be the fifth most common type of anxiety.⁵

Dental anxiety impacts the individual's wellbeing in various ways. It affects the individual's oral health, as dentally anxious people tend to delay or avoid visiting the dentist. More fearful individuals cancel or don't show up to their appointments.⁶ This leads to worsening of their oral health condition. Dental anxiety also impacts the person psychologically. Dentally anxious patients suffer from the feelings of fear prior and during the visit, and feelings of fatigue after the dental visit. Cognitive impacts include negative thinking, fears and beliefs. Avoidance, behaviors related to eating, oral hygiene, self-medication, crying, and hostility are some examples of the behavioral impacts of dental anxiety. Sleep disturbances were also reported. Dentally anxious patients might suffer socially as their self-esteem and confidence levels are negatively affected.⁷

Dental anxiety is caused by multiple reasons. The dental clinic environment has a role in initiating dental fear.⁸ The characteristic sights, sounds, smells of the dental environments were linked with the feelings of anxiety by some patients, who also experienced pain anticipation.⁹ Pain is prompted by both physiological and cognitive components, and dentally anxious people may experience both inflated pain expectancies and perceptions.¹⁰ Other causes of dental fear include bad previous experiences, feelings of lack of control, powerlessness, and fear of the unknown. Parental fear plays a role in children's perception, which can be a root cause of dental anxiety.¹¹ Anxiety is subject to stoking by sensory triggers, the sight of needles or air-turbine drills, noises from drilling and people screaming, eugenol and cut dentine smells, as well as the sensations arising from vibrations of high frequencies.¹² "However, it has been proposed, and evidence suggests, that how a person perceives the dental environment is a considerably more important determinant of dental fear and avoidance than having had a previous distressing experience at a dental visit".

Dental anxiety not only affects the patient, but it is also stressful for the dentist. The Dentally anxious patients are uncooperative, thus requiring more time and energy and more resources compared to the non-dentally anxious patient.¹³ This type of anxiety was observed to obstruct the efficiency of dentists' practices, because it is often seen as the primary cause of unsettling behavior in patients within the dental environment, thus creating a negative effect on the manner of dentists and their success of performing dental treatments.¹⁴ Furthermore, the dentist acting as a primary source of pain infliction, is a

common typecast amongst patients with dental anxiety. Consequently, this could have a negative effect on some patients towards having the best suited dental treatment as well as impeding communication between both parties.¹⁵

This project aims at creating a less stressful dental environment. This will not only affect the patient's stress levels, but the dentists' stress levels as well. Thus, creating a better experience for both.





Approach

This proposal aims at reducing the stress levels in the dental environment. Which can be done through researching and reviewing relevant qualitative and quantitative analyses regarding the problem. Quantitative analysis can be obtained through statistical data found in research papers and scholarly articles. While qualitative data can be obtained through interviews, precedent studies and literature review. However, the greater emphasis will be placed on the qualitative data.

Conducting interviews with practicing dentists will provide a more focused and relevant perspective, which would facilitate the understanding of the problem. Asking them questions about the patients' journey in the clinic until they reach the dental chair and the type of stressors they face during that time, will give a better understanding of their experience. Another set of questions regarding the clinic design and what can be changed, will help provide solutions for better patient outcomes. Two dentists will be interviewed, one specializing in pediatric dental care and the other in adult dental care to attain information regarding different age groups.

The literature review will aid in understanding the various means of managing dental anxiety. Literature regarding the psychology of the built environment and how it affects the people interacting with it, will provide a range of solutions that can be implemented in the dental environment. Positive distraction and biophilia will be studied in depth.

Precedent studies will also provide valuable information in the understanding of the problem. Studying the existing challenges in the current dental environments and how other designers managed to approach and solve them, will help in the final outcome of the design.

In conclusion, information gathered through these qualitative methods will be of great profit in designing a relaxing dental environment, whose target is to encourage dental anxious patients to pursue their oral healthcare. This can be achieved by eliminating some stressor factors and introducing some new design elements, which will decrease the patients' fear, which is the main reason for avoiding pursuing dental care. ¹⁶

Interviews

First interviewee is Dr Sandra Hamdy Elkhatib . She is a Consultant in Endodontics, BDS, NBDE, DCLINDENT, Mendo, RCSED.

She is trained and certified from USA and UK, she is certified from Royal College of Surgeons of Edinburgh, awarded the Doctorate degree from UK, and American Board Certified. She had her residency at the New York Dental Hospital and at Charles Clifford Dental Hospital UK, NHS settlement.

Dr. Elkhatib has been treating patients across UK, USA, Egypt and Qatar.

. Can you describe the patient's visit from his entry till he reaches the dental chair?

On the patient's arrival, he/she checks in, and sits in the waiting area till it's time to meet the dentist. They first discuss the patient's history and the treatment plan. Then, the dentist starts the dental procedure.

. Is the dental chair and dentist's desk in the same room? is it better if they are separated?

I have worked in different style clinics. The American style is the one where the doctor's office is in a separate room than the clinic. The dentist leaves his office and goes to treatment rooms which only have a dental chair. So, taking the patient's history and discussing the treatment plan and even signing the consent happen while the patient is sitting on the dental chair. I don't prefer this style because if the patient sits right away on the dental chair they start recalling the memories of any traumatic dental experiences they had before.

Whereas there is another style, where the dentist's desk and the dental chair are the same room. I prefer this style because in the beginning of the appointment, it is important that the patient gets to know the doctor, eases a little bit and builds some trust away from the dental chair which is stressful.

. How can the dental treatment room be less stressful to the patient?

Distraction is the most important factor. The patient can watch a movie while the dentist is working. If the dentist is working with some type of microscopy, some patients like to see what is happening on a screen while the dentist is working.

Music is also an important one. Asking the patient's favorite genre and playing it will make the procedure less stressful. Music increases the pain threshold and as you know pain has a huge psychological factor. VR glasses are also very helpful, because the patient forgets the setting he/she is in and focuses on the new environment that he is in. Sometimes we

ask the patients to bring their headphones with them. It is actually better than just listening to music being played in the clinic, because then the patient can't hear the drill's sound. Some patients get really annoyed hearing the drill's sound and their stress levels increase. Art work is more important in the waiting area especially wall art. It is not great importance as the patient doesn't see it while he/she is in the reclined position. Lastly, wider rooms are better than smaller rooms.

. Where is the Xray performed?

Easy access to Xray is important. The panoramic Xray has to be in a separate room whereas the most common Xrays used, should be in the same room to make it easier for the patient and enhance the patient experience.

. When you perform the xray, do you go out of the room?

The staff gets out of the room due to safety reasons so that the accumulative radiation levels stay in the safe zone.

. Do you feel patient gets get anxious when you get out of the room? is visual contact necessary?

If the patient gets informed by the dentist about the procedure, they don't get anxious.

. What are the other rooms that are important in dental clinic?

Sterilization room should be located in same floor for easy access. Staff lounge is very important because if the staff are in good mental and emotional state, the patient will get the best treatment possible. Dental labs and Cadcam (computer aided design, computer aided manufacture) technology also decreases the number of patient visits, where

instead of making multiple visits to the dentist, a single visit will only be necessary. Thus, decreasing the stress of patients who already have dental anxiety.

. What are patients mostly afraid of?

A lot of patients have dental trauma, which is very common due to previous bad experiences. But most of patients are afraid of the anaesthesia injection, the sound of the drill and spread of infection. For the anaesthesia injection, the dentist tries to distract and reassure the patient to decrease his stress.

. Where are the tools stored? and while working do you put them in front of the patient?

They are stored in cabinets inside the treatment room. Before working on a patient, the pouch with the sterilized instruments has to be opened in front of the patient so that he sure they were used before. If the patient is really phobic, then the tools are placed out of his/her sight. If he is wearing VR glasses, he/she will not see them.

. Can the sound of the drill be heard outside of the room?

Yes, sometimes it can be heard outside of the room. Even if the doors are thick, sound can still be heard outside and of course patients who hate this sound or are afraid of it will get anxious. That's why I turn up the music while working to mask the hand piece sound.

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. Any other methods to enhance patient comfort?

The availability of a pillow which is especially made for the dental chair is useful. Increasing patients comfort in general decreases their anxiety. It is specifically important in patients who have neck or jaw problems.

A blanket is also very useful. I had some patients once they sat on the dental chair, they started shivering and had panic attacks. After reassuring them and making them warm, they eased and the procedure was completed successfully. The concept is to decrease any discomfort that can happen to the patient.

Some clinics have a massage setting in the dental chair.

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. What other improvements can be made to the environment that could help improve the patient's experience?

Short waiting times and easy access to reception desk are important. Waiting area should be relaxing and not very formal to ease the patient's stress. Receptionists should be friendly.

The dental environment helps a lot in the stress levels. Distraction is important as we mentioned. The dental clinic's view is very important in decreasing patient's anxiety and the dentist's stress levels.

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dentist's stress levels.

. Does the dental clinic have multiple dental chairs? does it affect patient anxiety levels?

These are mainly found in dental schools. However, I saw it in some clinics but not in Qatar. Even if the chairs are separated by partitions, patients can hear each other and if a patient is anxious, it will affect the other patients in the room and it will increase the stress levels. This is particularly true in the case of pediatric patients. It is also not very good for patient privacy.

Second Interviewee is Dr. Dina Salah. She is a Specialist in Pediatric Dentistry. She got her degree from Ain shams university, Egypt and did her masters degree there. She also did her fellowship in UCSF school of dentistry, USA. She treated patients in Egypt and USA.

. How can the waiting room environment decrease child's anxiety?

For children, waiting is very boring and if the child is anxious, the waiting time will be very difficult for him/her. That is why the waiting room should be interesting to the child. It should have cheerful colorfults. In some of the clinics I worked in, there was a separate playing room that had a slide and coloring books, as well as toys fixated in the room's floor. Their drawing can even be hung on the walls so that he feels emotionally attached to the space.

In addition, The receptionist, who the child meets first, should be friendly and cheerful. The dentist even can go and take the child from the playing/waiting room, after playing with the child for a bit to ease him/her and break the ice.

. How can the environment in the dental treatment room reduce patient's anxiety?

The treatment room's the design has to attract the child's attention. The dental chair itself should look different than the adult chair. Some are colorful and some can have the shape of a cartoon figure.

The instruments especially the anesthesia syringe is put inside a cartoonish cover and has to be placed out of the child's sight.

Gifts are always given to children when he first arrives and after the visit for encouragement.

The walls should have some cartoonish murals.

Distraction is very important. In some clinics, the child can watch a video on a screen that is attached to the dental unit while the dentist is working.

. What are the pediatric patients mostly scared of?

Kids are mainly scared about anything that is unknown. Even the appearance of the dentist can be scary to them, which is why it is important for the attire (mask, scrub, etc.) to be funny and comical instead of being plain and bold. Slowly introduce them to the chair and the equipment by telling and showing them what it does in a friendly and playful manner.

. How many people are present in the room while the patient is being treated?

In most countries, the law states that a dental assistant has to be present with the dentist and the patient at all times. Sometimes two dental assistants work with the dentist.

. Do the parents stay with the patient in the clinic?

Yes they stay with the patient in the treatment room so that the patient feels safe. Children more than 7 years old are less fearful and can stay alone. However, I worked in clinics where the parents are asked to leave but I noticed their presence increases the patient's anxiety.

. Is it better for the dentist that the parents leave the room and stay in a neighbouring room where they have visual contact with the child?

It will not affect the dentist's work neither positively nor negatively. However, it will increase the child's anxiety.

. Do you think placing the dentist's desk in a room different from the treatment room would be beneficial? and why?

No I don't think it will be beneficial because changing rooms will give the child fear of the unknown all over again. If the patient stays with the dentist in the same setting will be more beneficial.

In general, during the child's first visit, no procedure is usually done. The patient gets introduced to the dentist and given a toy or some stickers to make him/her feel more comfortable with the dentist.

. What other improvements can be made to improve the patient's experience?

Patient education is very important. Giving the children lectures about oral health in an entertaining way e.g. in the form of songs or using teeth models where they can learn how to brush their teeth, will make them interested. Having sinks where they are given kits to brush their teeth the way they learned it in the videos will give them confidence. When the

patient comes to their following appointment, they come encouraged and less anxious.

. What type of light do you mostly depend on while working? Is the type of ceiling light important?

Mainly, the task light that is attached to the dental unit, is the important one. If the dentist is using microscopy then the task light is not even very important. The light that is emitted from the microscope is the one used. The ceiling light is used for illuminating the room.

. Are there any measures that were taken that were not successful?

Distraction doesn't always work with all children. Hyperactive, uncooperative, special needs and extremely anxious patients usually need sedation or general anesthesia.

Literature Review

Dental anxiety is considered the main reason for the avoidance of getting dental care. To combat and quell the patient's dental anxiousness, the patient should be assessed in an isolated session, then on that basis they should be given a treatment session. This session should be done in a less stressful dental environment to alleviate anxiety and fear.

In general, dental anxiety is treated within the dental clinic by implementing non-pharmacological interventions, pharmacological interventions, or a blend of both. This differs according to the dentist's expertise and experience, level of dental anxiety, patient personality, and clinical circumstances.¹⁷ Pharmacological interventions include but are not limited to sedatives such as benzodiazepines, nitrous oxide and further agents that are implemented by a number of ways, frequencies, timing and blends. While non-pharmacological interventions, can be clustered into: (1) communication skills, bonding as well as trust building; (2) techniques of behavior modification; (3) cognitive behavioral therapy (CBT) and (4) physical restraints.¹⁸ In the case of pediatric patients, physical restraint and pharmacological intervention are viable options but are possibly a physical risk to the child.¹⁹

Despite the significant role the dental office ambience plays in introducing dental fear and anxiety,²⁰ it should be taken into consideration that the collected works in this area are scarce. A considerable amount of research is needed before acquiring precise ideas, which can be implemented in a clinical environment with the aim of reducing dental anxiety in patients.²¹

This literature review will only focus on the approaches that can be applied to the dental physical environment to decrease dental anxiety and make the environment less stressful for the patients. These include positive distraction, and biophilia.

Positive Distraction

Positive distraction is an element, which stands out in the environment, and presents a feeling of positivity that diverts focus away from stressful or anxious thoughts.²² The effect of positive distraction was compared between different literatures.

In one study by Fux-Noy et al. addressing the effect of the waiting room's environment on level of anxiety experienced by children prior to dental treatment, the role of positive distraction in waiting rooms was compared between two groups of children. The first waiting area was multisensory that had a lighting column which allowed children to climb and touch; along with loudspeakers that played rhythmic music. The second waiting

area was traditional, purposed for the control group. It was noticed that the multisensory waiting room was of less importance in reducing children's dental anxiety before treatment sessions. It was concluded that preventing emergency visits to the dentist, while creating a routine schedule with reduced waiting times are the main factors that reduce children's dental anxiety.²³

Meanwhile, in a different study, which included 212 children ranging between 6 and 11 years of age, the majority of children were inclined towards music and the freedom to play in the waiting perimeter. In addition, walls with pictures and natural light had a higher preference from the children. Visual elements such as aquariums, televisions, oral hygiene posters, and plants were more preferable to them as well; plus sitting on beanbags and chairs.²⁴

On a similar note, in another study conducted on a group of 80 children aged between the ages of 4 and 10, who had their first dental visit alongside their parent/guardian in the department of pediatric dentistry, were divided into 4 equal groups. The first was the control group, while the second was exposed to an audio distraction technique. The third and fourth groups were both subjected to an audio-video-distraction (AVD) technique, where the televisions were mounted to the chair and ceiling respectively. Each member of the study was evaluated during four dental visits. The ceiling-mounted AVD had the most effective impact on reducing anxiety, while the chair-mounted AVD had the second most effective impact. The audio distraction was the least effective distraction method but proved to be better than the control group. Pediatric patients experiencing AVD would have a distraction applied to multiple senses; they would keep their eyes focused on the televisions, not on the treatment process, while the audio would cover up the unpleasant sounds of the dental treatment process such as the sound of the hand piece.²⁵

In the case of adult patients, the effects of Virtual reality (VR), which is an example of positive distraction, was studied in a group of 70 grown-ups undergoing dental treatment in a randomized controlled trial. They were split into three groups: (a) standard care + coast VR, (b) standard care + urban VR, and (c) standard care control group. Group (a) that had the element of nature in their VR reported a reduction in both experienced and recalled pain in comparison to groups (b) and (c).²⁶ It should be taken into consideration that one of the common fears, which lead to dental anxiety, is the fear of pain.²⁷

The dental environment can be perceived as calm and unthreatening through avoiding bright lights and the playing of soft music. In one study, the researchers noticed the role of music therapy and its effectiveness on patients, who have dental anxiety, in

addition to those experiencing their first dental procedure. Music created an attractive ambience during the visit for those people, who became distracted from the anxiety inducing process.²⁸

Bare and Dundes conducted a study that reported a preference towards a more modernized and contemporary environment by patients, suggesting that walls could be decorated with pictures and posters, while the waiting area could provide an ample supply of interesting reading material in the form of books and magazines. While in the treatment room, unpleasant sounds produced from the instruments could be muted when possible. Prominently, patients suffering from anxiety should not wait for a long time, preventing them from absorbing and formulating anxiety. Masking the smell of unpleasant odors such as eugenol can be achieved through the introduction of pleasant ambient odors to the environment, which also plays a role by their potential anxiolytic effects. This can be overcome through aromatherapy, which is an alternative approach that depends on the use of essential oils extracted from aromatic plants. Studies have pointed towards this being more effective on moderate cases of anxiety rather than severe cases.²⁹

It can be concluded from the studies presented, the importance of the positive distraction in the clinical environment, and that it provides clinicians with methods that are safe, effective, and economical for usage.³⁰

Biophilia

Biophilia hypothesizes that humans have inherent connection with nature, and it has become a new method to integrate the positive experiences of nature into the design of the built environment, such as the dental office. Studies concluded that in a clinic environment, which has natural sounds, aromatherapy (inhalation of aromatic plants essential oils for therapeutic purposes), green plants and views of nature, allows patients to have reduced levels of mental stress and an increased tolerance for pain. An interior environment that depicts a sense of welcoming and understandability, while being aesthetically pleasing and relaxing encourages a greater sense of trust.

Designing healthcare spaces that convey a sense of reconnection with nature, offer support that is therapeutic and could possibly have a positive effect on the physical and psychological well-being of the patients. International studies have reported a confirmed 95% of patients, who were exposed directly into contact with nature, described lowered levels of stress, a more positive mindset and a better coping capability. Also, the presence of green plants in treatment areas improves the psychological state of the patient, inducing lower levels of pain, anxiety and fatigue. Moreover, the presence of natural light has a

direct impact on serotonin levels (a neurotransmitter, which has an implication in the pathophysiology of mood disorders, migraine, and hypertension.)³¹, prompting a lessened experience of pain. This resulted in reducing the use of analgesics by 22%, while providing a drop in costs of healthcare by 21%. Natural elements integrated into the design have a role in improving patients' perception of the environmental value, as well as a better rate of recovery. This is due to the natural elements' ability to elevate visual comfort (light is absorbed rather than reflected), coupled with olfactory comfort (by essential wood oils).

Lately, a number of 14 biophilic design patterns identified an extensive view of design tools and applications, plus chances of providing better health and well-being of patients throughout multiple levels of care. Those patterns can be further categorized into three groups: nature in the space, natural analogues and nature of the space.

First, nature in space, which is the direct experience of nature, is essentially the direct and real contact with nature within the designed space. Examples of this are natural lighting, variability in airflow and thermal flow, water, and the visual connection with nature through natural landscapes, or having a myriad of plants and vegetation indoors.

Second, there's a possibility for conceiving interventions that aim to enable an indirect perception of nature, which can be in the form of contact with the image of nature or exposing patients to certain patterns and occurrences from the natural world (natural analogues). The basis of this group refers to the recreation of natural forms, colors that occur in nature, and natural materials. Advancements in technology can also provide an immersive experience of nature through VR as the example mentioned earlier.

Third, experiencing spaces and locations is affected by the nature of it (nature of the space). As a matter of fact, biophilic design has the ability to determine the relationship between clinical environments and its patients, giving a feeling of well-being and positive effects on their health. Portraying a sense of protection and usage of the patient's point-of-view in interior spaces allows this to be achieved. Different ways of guaranteeing the comfort of patients include designs, where patients are well oriented with their options and available opportunities in a clear, understandable and consistent manner e.g., by means of effective orientation and wayfinding systems. This allows patients to feel comfortable by eliminating the fear of the unknown.³²

In conclusion, the literature review studied two of the approaches that are applied to decrease patient anxiety in the dental environment. The sources focused only on the psychology of the built environment and its effect on its users rather than the psychotherapeutic or pharmacological interventions that can be done to decrease patient

anxiety. The proposed dental center will be using the elements of biophilia, and positive distraction to create a less stressful environment, which will positively impact the patients' experiences, which in turn will improve their oral health.

Precedent studies

Project Name: Go orthodontistes Orthodontic clinic

Location: Brossard, Canada

Architect: Natasha Thorpe (Natasha Thorpe Design)

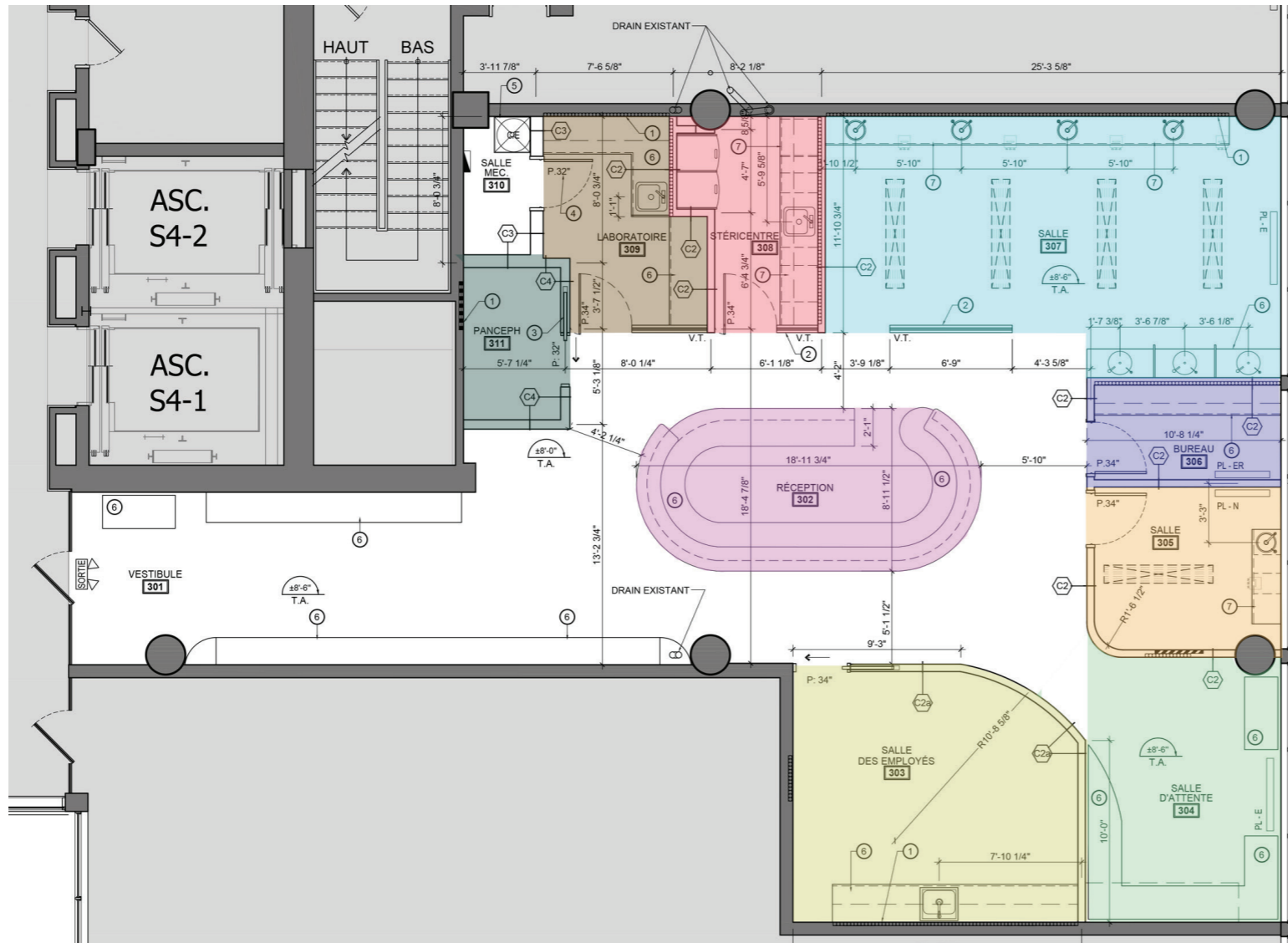
Year: 2017

Area: 1,943-square-foot (180-square-metre)

“In the context of a clinic, sensitivity to visitor experience is essential, as feelings of anxiety are often present,” said Thorpe.

She stresses how essential natural materials coupled with an open-plan layout are to simulate a comfortable and easy feeling. Panels of slatted wood as well as ambient lighting are used to create a better feeling of easiness for visitors in an orthodontist clinic, which is designed by Natasha Thorpe.






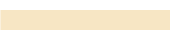







Space Planning

Visibility is enhanced between doctors and their patients by keeping the office as open as possible. Visitors are naturally guided, giving them the ability to keep an eye out for their surroundings, which results in a feeling of being at ease.

The main space has a central reception, which forms the space's focal point.

All the patients rooms are placed towards the windows to allow patients to look at the view and for day light to enter the space. (See figure 1)

Fig. 1 An open floor plan enhances visibility and decreases apprehension. Treatment rooms are placed next to the windows for a feeling of connection with the outside.

302 Reception		305 Consultation room		308 Sterilization room	
303 Employees room		306 Office		309 Dental lab	
304 Waiting room		307 Treatment area		311 X-ray	

Circulation and Egress

Circulation paths inside the clinic are clear which decreases confusion. It also allows for easy egress in case of emergency.

Exit it is considered to be the portion of means of escape which is protected from the area of incidence and provides a safe path to the exit discharge.

Exit access is the pathway from any area of the building to an exit.

Exit discharge is a portion of a means of egress between the termination of an exit and public way (see figure 2)

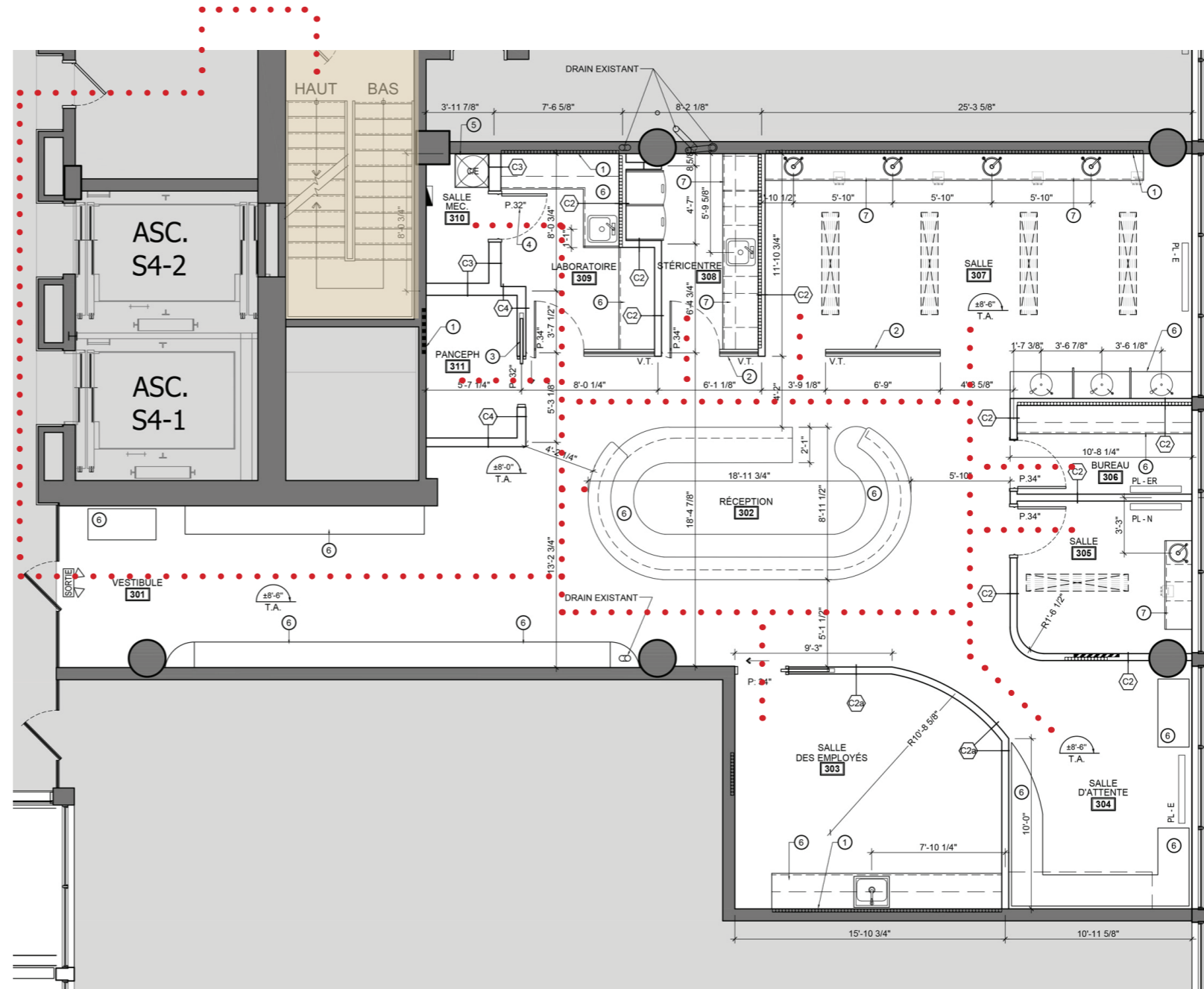


Fig 2
A diagram showing clear circulation and means of egress

The central reception is dedicated space that is planned to be friendly and warm welcoming the patients when they first enter setting the tone for their visit. (Fig 3 shows reception area)

There is a long entrance corridor, which utilizes a chance to create vital storage space for the office that is 180.5 square meter in area. There are two types of storage space on a single side of the hallway, one for orthodontic appliances, while the other is for closet space (See fig 4) Storage is important in creating a clutter free environment.



Fig 3
Image showing the reception desk welcoming the patients when they first walk in which is important in decreasing their anxiety.

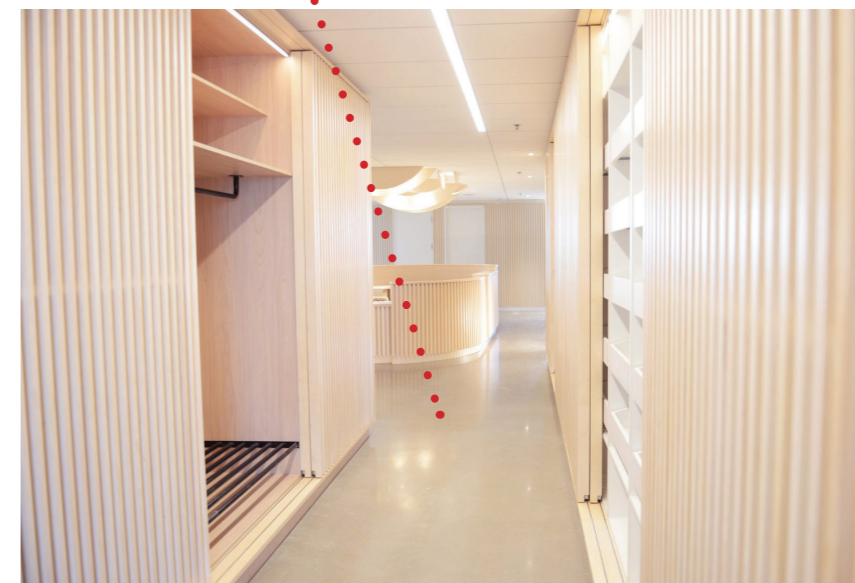
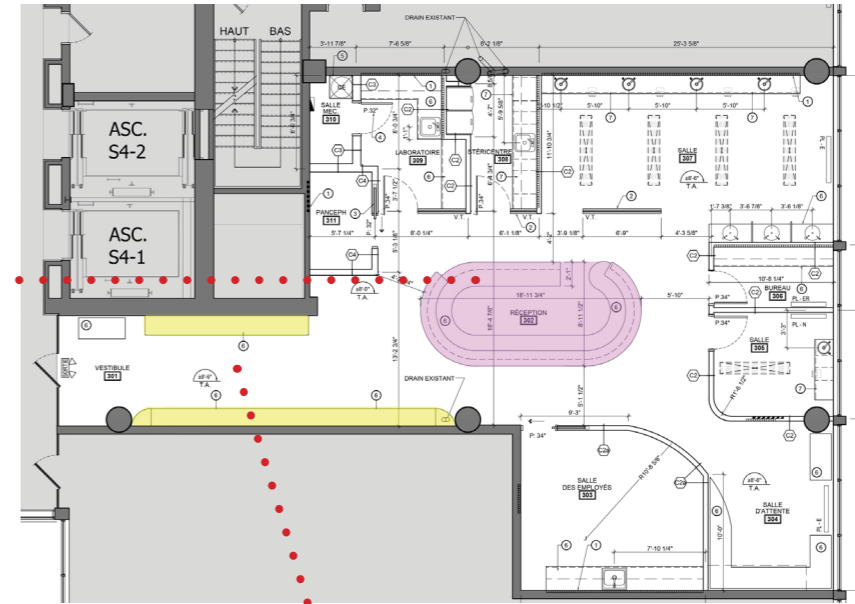


Fig 4
Image showing the long corridors which are used to create a clutter-free environment and hide the instruments from the patients, which is important in reducing their anxiety.

Privacy

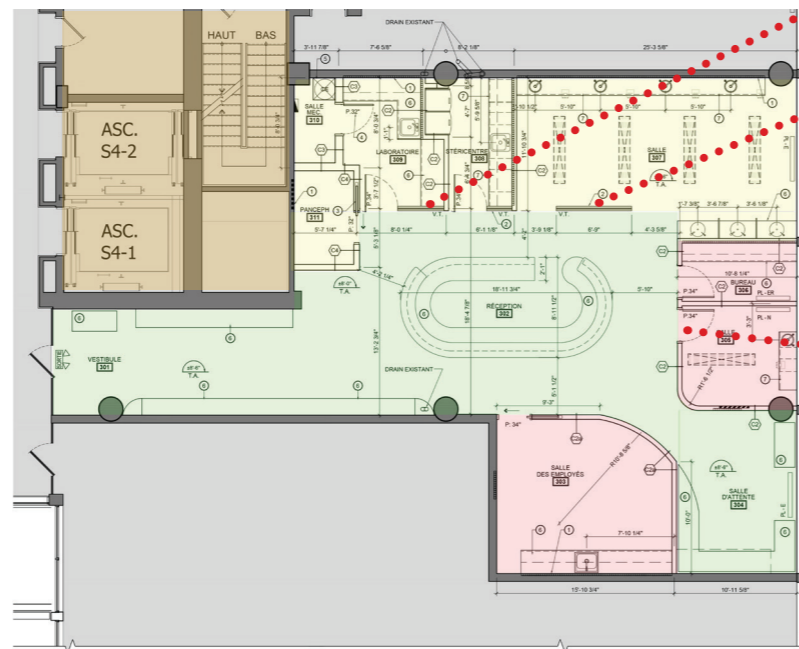
Public and private areas are highlighted through the spatial configuration, which is achieved by material opacity that depends on the visitor's point of view.

The visibility and opacity of partitions and wall surfaces alike were created differently.

Dental chairs inside the procedural space are veiled behind a mesh of bronze and a panel of glass. (See fig. 5)

Clinicians are afforded a semi-private environment, where transparent glass alongside a radiant white film were applied. This is implemented in specific areas, such as the lab or the instrument sterilization center. (fig 5)

The consultation room, like every other private area, is absolutely opaque.(fig 6)



Private
Semi private
Public
Service



Fig 5. Image showing how different degrees of opacity was used in different areas depending on the privacy levels



Fig 6 Image showing the use of opaque doors in private areas



Fig 7 Image showing the use of daylight in waiting room which is important in enhancing patients mood



Fig 8 Image the use of daylight in the treatment room which is linked to reduced pain, and less patient need for analgesics

Lighting

The waiting room, consultation room and treatment area are bathed in daylight creating lively spaces which is important in reducing stress.

Studies have shown that exposure to daylight has been associated less pain, a better mood, and a lower need for analgesics needed by the patients. (See fig 7)

In regards to the staff, the reported positive effects of daylight were reduced absenteeism and errors, decreased fatigue and less eyestrain. These benefits are important in delivering quality care for the patients ³³ (See figure 8)

The choice of artificial lighting in the space creates a good ambience. The dental environment can be perceived as calm and unthreatening through avoiding bright lights. However, Indirect light is usually recommended in any area with patient lying on their backs ³⁴ (See Fig 9)



Fig. 9 image showing LED light used in treatment room to

In addition, the indirect light used (on top of the curved walls and under the waiting area's seat) further accentuates the different forms used in the space highlighting their variety. (See fig 10)



Fig 10 Image showing the use of indirect light highlighting different forms and creating an interesting interior



Fig 11
Image showing the use of wood in the X ray chamber to give it a less fearful machine like feel.

Color palette

“The palette favours light natural tones that showcase materials at their best and put visitors at ease”. The monothematic design was also chosen to enlarge “the relatively small office, for the environment that might have otherwise felt claustrophobic”.

The color palette used give a sense of calmness and warmth. White color is usually associated with luminosity and clarity, whereas the low contrast colors used create a softer feel ³⁵ throughout the clinic. The dark color was only used for the cabinetry.



Materials

BC Fir was used in all interior vertical surfaces in order to give a cohesive feeling.

The marble known as the Calcutta Oro as used to create variation and dramatic moments.

Adding a satin finish to the wood, polishing the concrete flooring and painting the walls and ceiling white, reflect light creating a more naturally illuminated space and decreases the need for artificial lighting.

Using Corian for flooring the entire clinic creates continuity throughout the entire office. Corian is easily cleaned which is important in creating an aseptic environment.

The focus on esthetics in healthcare setting create a non-institutional ambience which is considered an important criterion in healing environments. ³⁶

The use of material was particularly successful in the X-ray chamber. “The area most associated with fearful experiences in dental offices is often the X-ray chamber,” Thorpe said. “When placed inside the all-fir environment, the X-ray machine becomes altered by its context. It seems less scary and machine-like.” (See fig 11)

In conclusion, the design was successful in creating a more welcoming feel for the patients. It used the open plan, natural materials, ambient lighting in creating a less stressful environment. However, it could be improved in terms of privacy by creating partitions between the patients or putting them in separate rooms. In addition, Providing different types of seating surfaces in the waiting room can be used to respond to individual preferences will increase the patients' comfort while they are waiting for their appointments.



Soto Dental Clinic

Location: Vinaroz (Castellón). Spain

Interior design and branding: Vitale

Year: 2019

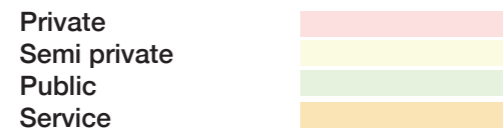
Area: 150 m2 Builder: AT4

“The Soto dental clinic aims to provide a real holistic well-being, both physical and emotional, showing a very differentiated business in the field of independent clinics.”

The place focuses on improving the patient's experience, while focusing on decreasing patients' stress and ensuring their comfort when upon their visit to the clinic.

The projects aim is to transform situations of discomfort or stress which are prevalent in dental patients, into confidence and easiness.

Types of spaces



Private areas are areas used in treating a single patient and the staff offices

Semi Private areas are areas where more than one patient can be seated at a given time

Public areas are the reception and waiting area where multiple people can be seated together. (see fig 12)

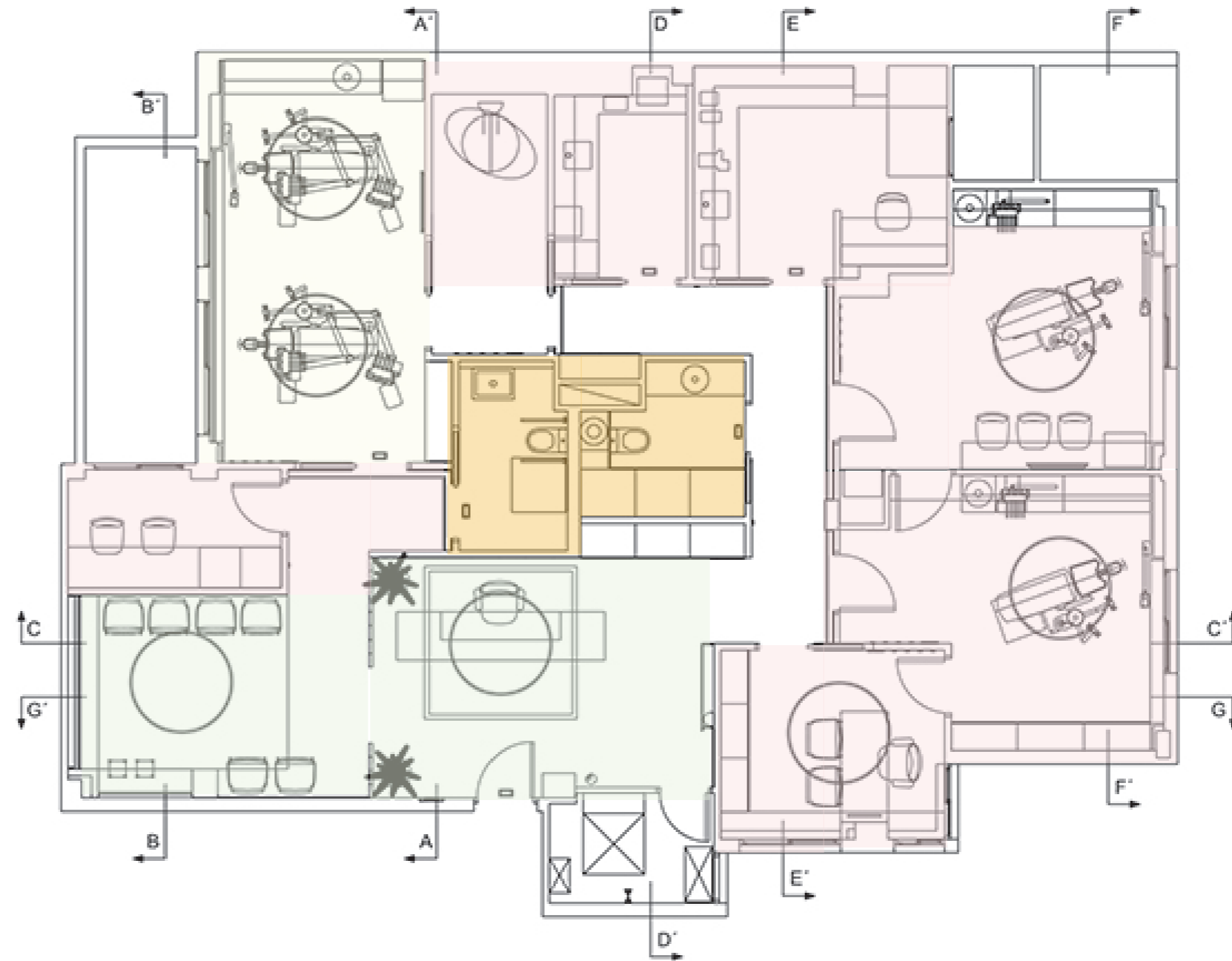


Fig 12 Diagram showing classification of spaces in terms of privacy

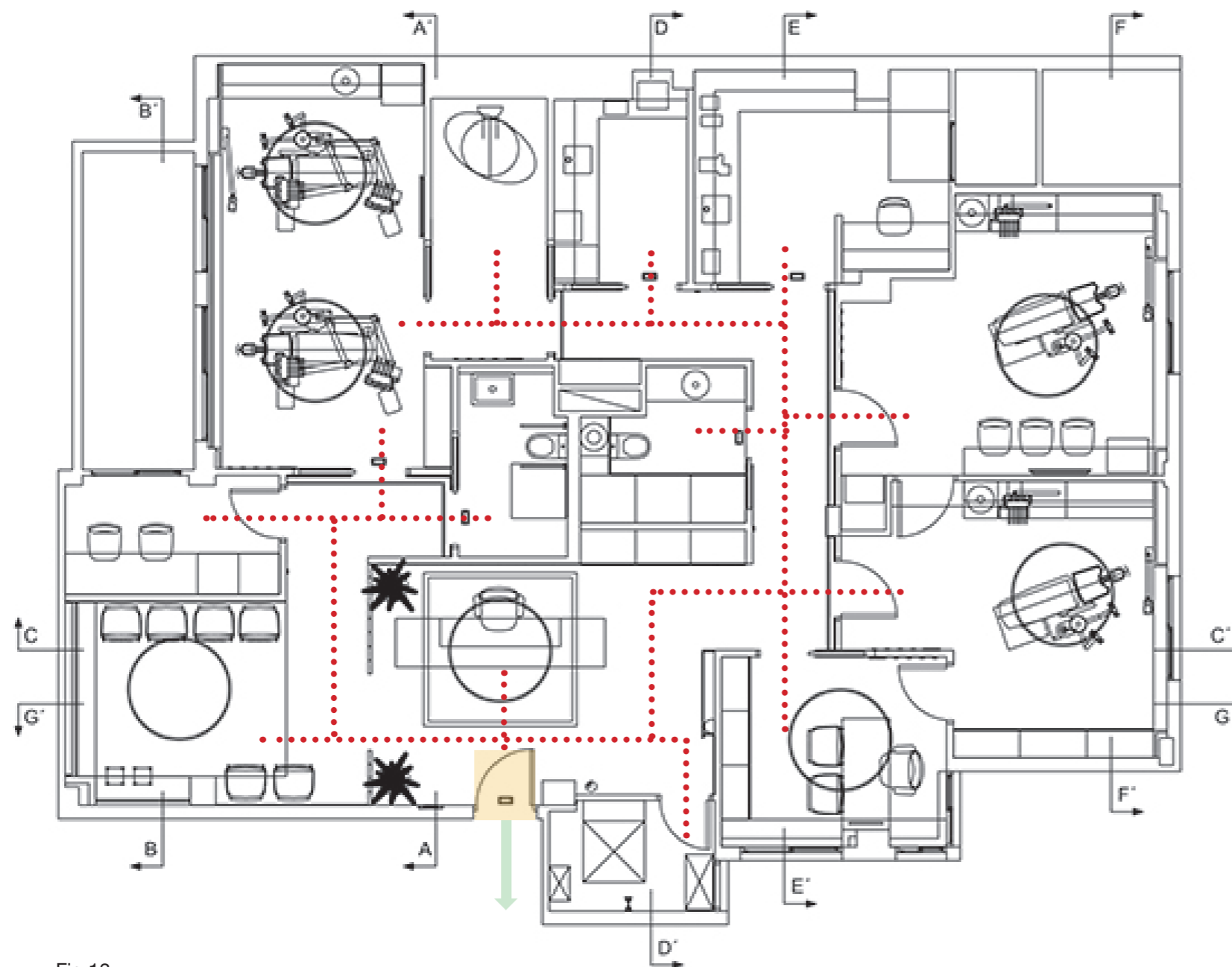


Fig 13
Diagram showing means of egress

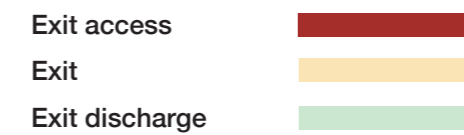
Circulation and Egress

Circulation paths inside the clinic are clear which decreases confusion. It also allows for easy egress in case of emergency.

Exit it is considered to be the portion of means of escape which is protected from the area of incidence and provides a safe path to the exit discharge.

Exit access is the pathway from any area of the building to an exit. (see figure 2)

Exit discharge is a portion of a means of egress between the termination of an exit and public way. (see fig 13)



Way finding

Easy way finding decreases confusion and makes the patient's trip inside the clinic easier, thus enhancing their experience. Numbers are clearly marked on the doors, using a different color, so that patients can see them easily. (Fig 14)



Fig 14
Image showing using a different color for easy wayfinding



Fig 15
Image showing the calming colors and the warmth created through materials used inside the clinic

Color palette

The color palette used give a sense of relaxation which is especially important in dental environments (see fig 15)

The blue color gives quality of relaxation, srenety and loyalty
green nurturing, healing
a cool color schame can make time pass more quickly 39
(see fig 15)



Materials

“The reception counter covered in large-format porcelain stoneware with stone decoration suggests different substrates and earth conglomerates. The terracotta lattices, which separate the reception from the waiting area, provide a warm and natural texture. The wood-effect vinyl slat flooring provides comfort and durability, as well as the required warmth.” (See fig 15)

Lighting

Fabric shades are used to control the amount of light entering the different rooms which prevents the formation of glare. Glare is considered a stressor in healthcare facilities. ⁴⁰

The soft artificial light in the whole clinic allows for illuminating the spaces without the need for bright ceiling lights.

Lights under the cabinets allow for illuminating the work surfaces. (see fig 16)



Fig 16
Image showing the use of shades to prevent glare inside the clinic which causes agitation



Biophilia

Natural elements were used throughout the space through the use of vegetation, natural scenery imagery or patterns of living creatures. These elements act as positive distraction methods enabling patients who are experiencing the feelings of pain or having anxiety feelings to take their minds off these problems for a short while. Choosing images or patterns of nature is the most preferred choice to relieve stress as humans evolutionary have a strong need to connect to nature. 41

Fig 17,18,19 showing the elements of biophilia which are important in giving the feeling of connecting with nature

Positive Distraction

The design put the kids needs into consideration. A small nook was created for the kids which allows them to play with toys diverting their focus away from anxious thoughts till their appointment time. ⁴² (See fig 20)



Fig 20
Image showing a kid's toy in the waiting area to distract them while waiting for their treatment



Fig 21
Image showing soft seating to enhance patient's comfort

Furniture

The furniture used throughout the space have arm rests and curved forms. A more comfortable choice of furniture can be done by providing different types of seating surfaces including seats for bariatric patients to respond to individual preferences. ⁴³ (See figure 20, 21)

In the waiting area, children's seating is also found which allows them to sit comfortably while playing (see figure 20)

Forms

Circular forms are used in various areas of the space which creates a coherent design.

“The brand is a fundamental part of the project. The circle, which represents balance and the holistic approach to health, takes on special prominence in lamps and lattices.” (see fig 22)



Fig. 22
Image showing the use of circular forms in branding for creating a cohesive design

In conclusion, Soto's clinic design used a the color psychology, natural elements, ambient lighting, positive distraction, biophilia to enhance the patient's experience while visiting the dental clinic. Easy way finding was also considered in their design.

Site Analysis

Country: Qatar

Location: Middle East- Asia

Area: 11,521 square meters

Language: Arabic (official) - English (widely used)

Geography: The land mainly has rocky plains, covered with a range of low limestone outcroppings such as in Jebel Dukhan and Jebel Fuwairit.

Qatar is a country located in the Middle East. It is a peninsula that juts into the Arabian Gulf. Qatar's largest islands are Halul, Sharouh and Al-Asshat.

Economy: After it got its complete independence from Britain in 1971, Qatar has been considered one of the most important countries in oil and gas production.

Religion: Islam

Population: 2.6 million

Capital city: Doha

Currency: Qatari Riyal

Political system: Since 2013, the country has been ruled by HH Sheikh Tamim bin Hamad Khalifa Al-Thani. ⁴⁵



Fig 23
Image showing the location of Qatar and its neighbouring countries

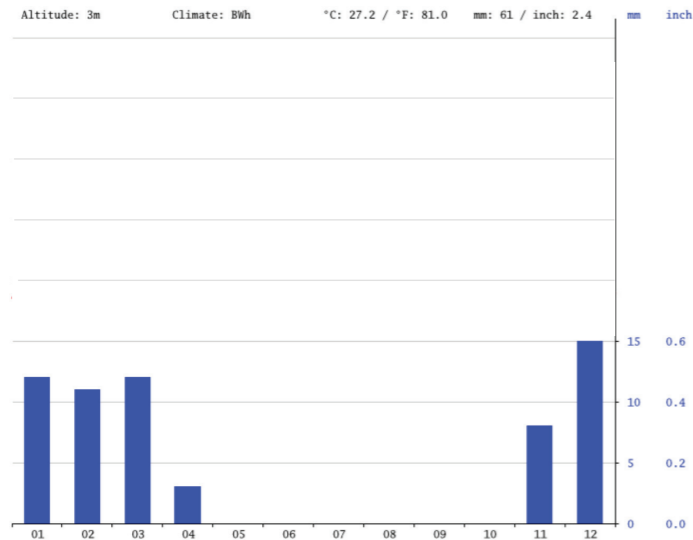


Fig 24
Chart showing amount of precipitation in inch per month

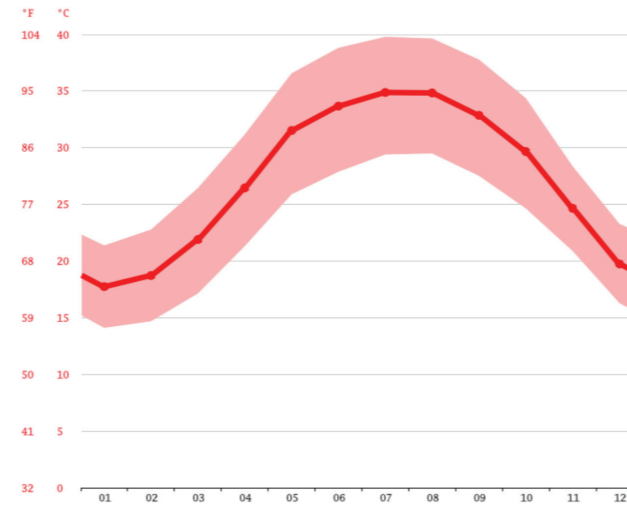


Fig 25
Graph showing the average temperature per month

Precipitation

The driest month is May. There is no precipitation in May. The greatest amount of precipitation occurs in December, with an average of 15 mm | 0.6 inch. (see Fig 24)

Temperature

July is the warmest month with an average temperature of 34.9 °C | 94.8 °F. The lowest average temperatures occurs in January with an average of 17.7 °C | 63.9 °F (see fig 25)

Humidity

The month with the highest humidity is December with an average of 69.22 %. The month with the lowest relative humidity is June with an average level of 43.60 % (see fig 26)

	January	February	March	April	May	June	July	August	September	October	November	December
Humidity(%)	67%	63%	55%	50%	44%	44%	50%	58%	57%	60%	63%	69%

Fig. 26
Chart showing average humidity each month

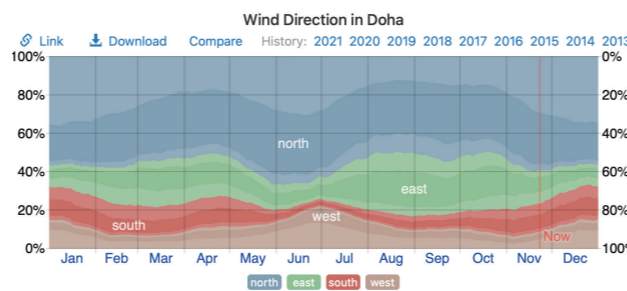


Fig 27
showing prevalent wind direction

Wind

The predominant wind direction in Doha is from the northwest throughout the year. (see fig. 27)

Lusail City

Lusail is roughly 23 kilometers (14 miles) north of Doha's city center, and covers an area of over 38 square kilometers (15 square miles). It will eventually be able to accommodate 450,000 people. ⁴⁷

It is a sustainable and a carefully planned city that exemplifies Qatar's enormous success. It incorporates Qatar's National 2030 Vision in the field of real estate development.

The 19 districts of Lusail City will include not just new residential, business, hotel, and retail opportunities, but also a full range of community necessities like as schools, mosques, medical facilities, sports, entertainment, and shopping centers. Among the areas are a dedicated entertainment city and an energy city, as well as a new financial district with towers created by world-renowned architects.

'The city of the future' features a 30% of the land area will be dedicated to green and open spaces to create a relaxed atmosphere, integrated with lively components of the city. ⁴⁸

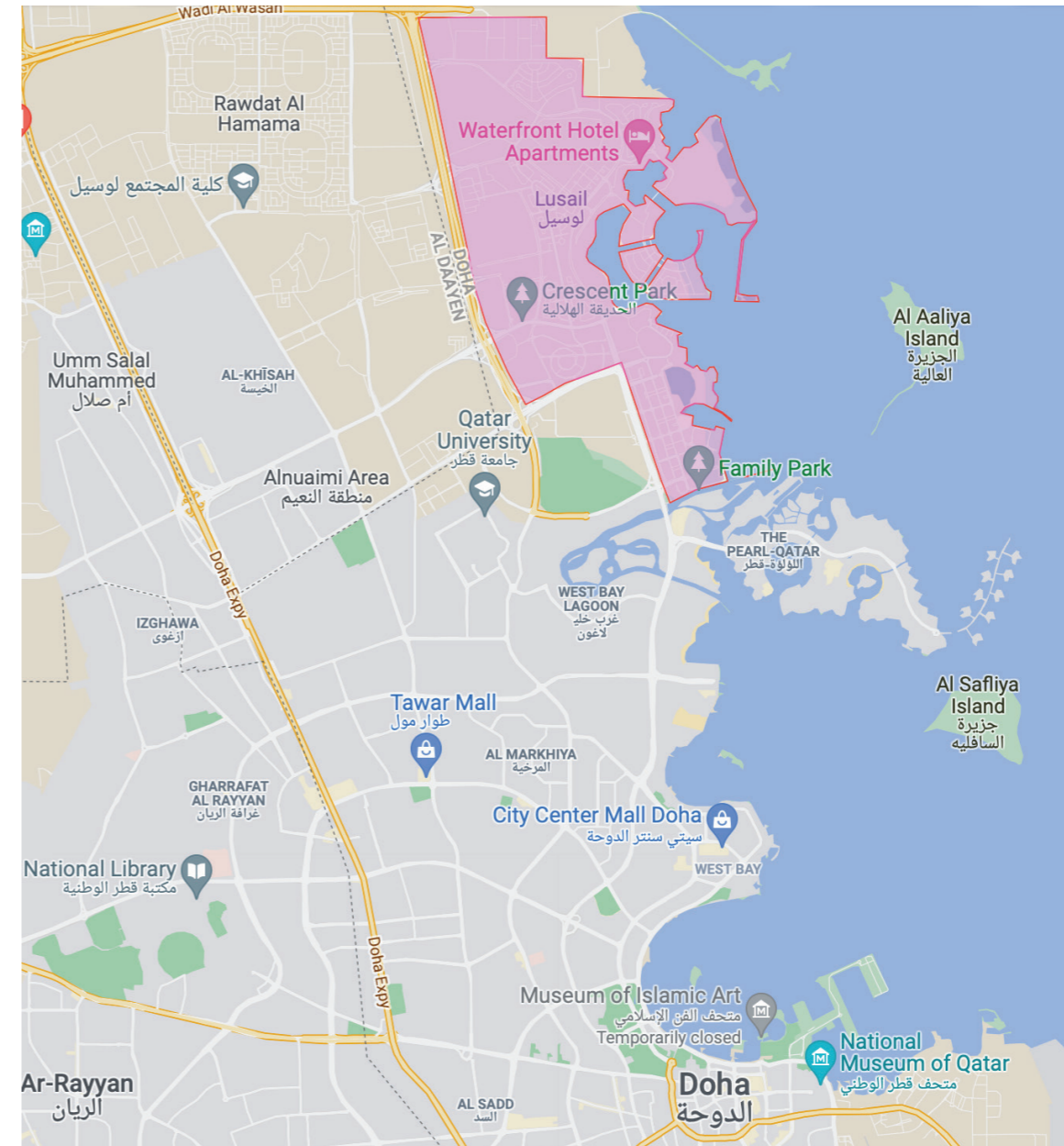


Fig 28
Image showing the location of Lusail in relation to Doha, the capital of Qatar



Marina Twin Towers

Location: Lusail area

Architects: ESquare Architects

Construction year: 2015

Occupancy: mixed

The Marina twin towers are located in Lusail. The Twin Towers prioritizes sustainability, with a major emphasis on the environment.

The Towers are classified as a green building and eco-friendly by the Qatar Sustainability Assessment System. ⁴⁹

This building was chosen due to a number of reasons. First due to its location in the Lusail city, being away from the traffic problem found in Doha ⁵⁰, making it a relaxing location away from the noise.

Secondly, due to its views. The tower overlooks the gulf in the north and east and south directions which gives the visitors a soothing view to look at while being in the tower relieving their anxiety.

The third reason is because of the amenities found in the tower such as the Cafeterias and small garden and terraces found in the tower which changes the perception of going to a doctor's appointment and makes the visit less daunting.

Lastly, Lusail has many iconic skyscrapers which gives the patients moments of positive distractions and mesmerizes them on their way to the building.

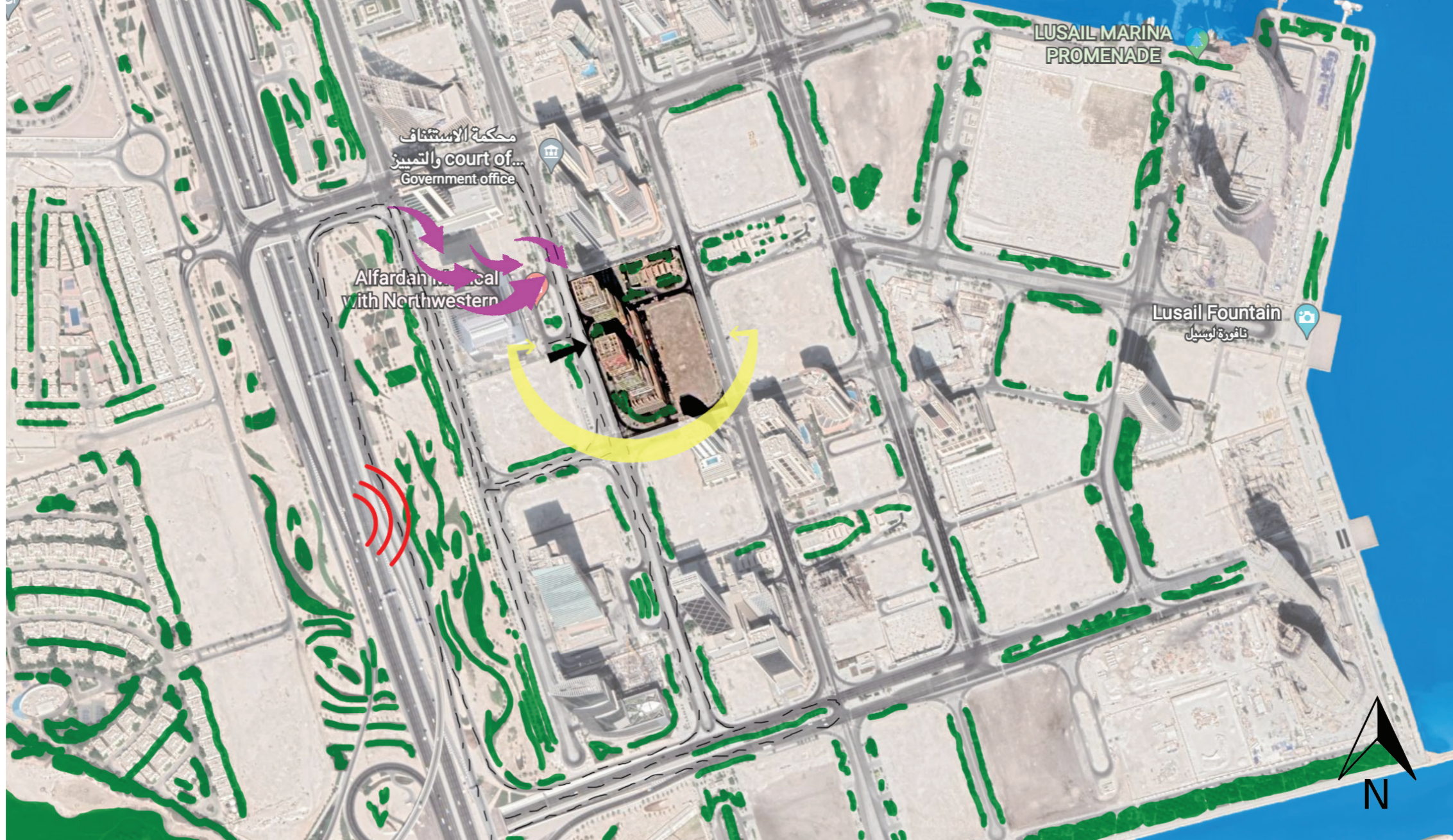


Fig 29 Diagram showing site analysis of the towers

Site Analysis



The site overlooks the gulf and vegetated areas which gives the patients a feeling of connection to the outdoors.
 The building is easily reached using the highway. However, it is far enough from the noise, which is important in creating a relaxing environment for the patients. (See figure 29)



Fig 30
An image showing the playful building form

The colorful and playful form of the building gives an interesting first impression when the visitor's first arrive



Fig 31
An image showing the visitor's parking

The presence of an easily accessible visitor's parking in the same building enhances the visitor's experience



Fig 32
An image of the building's entrance creating a protecting feeling for the visitors



Fig. 33 An image of the side garden and cafe giving the visitors an opportunity to destress before the appointment if they wish to use them

The entrance's form resembles a shield which implies a feeling of safety and protection for the visitors. In addition, the change of scale from a bigger to a smaller one, creates the notion of compression which gives a more intimate and welcoming feel. (Fig 32)

The vegetated area located at the side of the building will help reduce the feelings of stress patients might be having upon arrival.

The presence of the outdoor cafe will give the patient's the opportunity to ease the feelings of anxiety before going to their appointments if they wish to use it. (See fig 33)



The lobby is double high which gives the feeling of openness. The grand scale and the materials used (cast metal in the shape of squares and back lit marble) create a moment of drama. In addition, The use of different forms creates variety and grabs the patients attention and interest. (see fig 34)

Fig. 34
An image of the lobby giving a good first impression



Fig. 35 An image of the reception desk welcoming and guiding visitors when they first arrive. Vegetation and wood create a warm feeling

A reception desk is found on the left side when the patients enter which facilitates way finding. An interior environment that depicts a sense of welcoming and understandability, while being aesthetically pleasing and relaxing encourages a greater sense of trust. ⁵⁰(see fig 35)

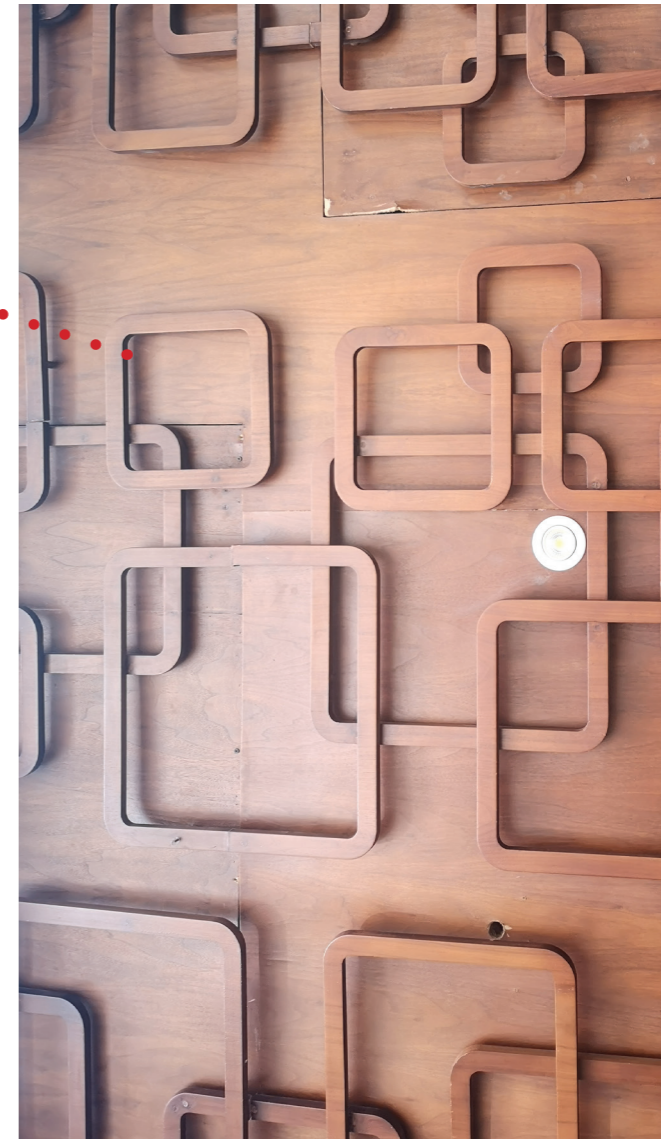


Fig. 36 An image of the ceiling above the reception desk

The use of a lower ceiling above the reception desk give a more intimate feeling. The use of the same pattern creates coherence. (see fig 36)



Fig. 37 An image of the cafe on the right side of the lobby creating a more relaxed environment. Music played eases patients stress

The presence of an indoor cafe gives the patients the opportunity to grab a drink before their appointment. The music played by the cafe, which can also be heard in the lobby, is a way to decrease patient's anxiety. (see fig 37)



Fig. 38 The way to the elevators showing variety of forms grabbing patients attention

The contrast between the curvilinear form used for the ceiling and rectilinear forms used in the space will grab the patients attention creating distraction.

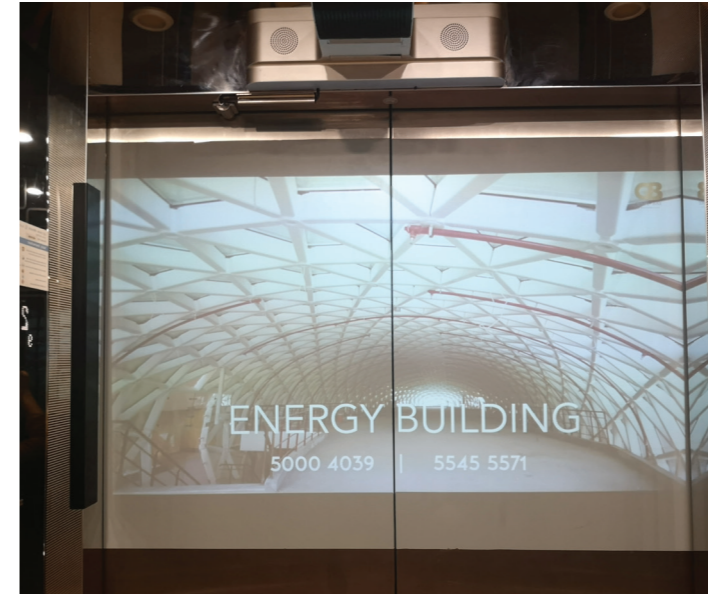


Fig. 39 Image showing distractions on the elevator door



Different Images are projected on the elevator's door distracting the patients on their way up (see fig 39)



Fig. 40
An image showing the pathway to the clinic

The natural materials used create a warm feeling. The color palette is neutral with an accent yellow color which is uplifting and give the feelings of optimism ⁵¹

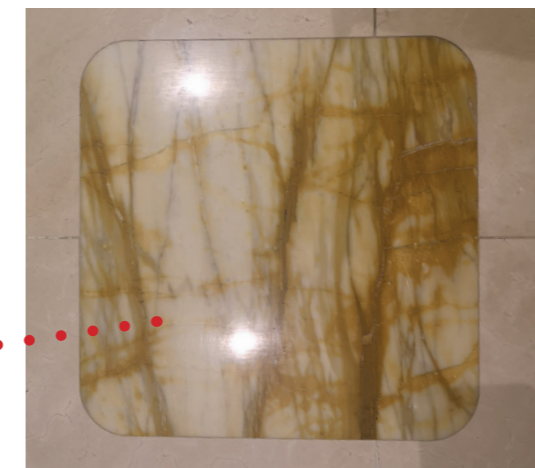


Fig. 41,42 A close up on materials

Wood veneer, marble floor with onyx accent tiles (see fig 41,42)



Fig. 43 An image showing the interior space

The space feels light and spacious. The glass facades allows day light to enter the space which is important in enhancing patient's mood. ⁵² The open space gives the opportunity of easily dividing the space based on the need.

A raised floor is used to hide all the wires underneath. It also gives the opportunity to extend plumbing which will be needed for the dental chairs. Columns are covered in white paint and ceiling tiles are used. (see fig 43)



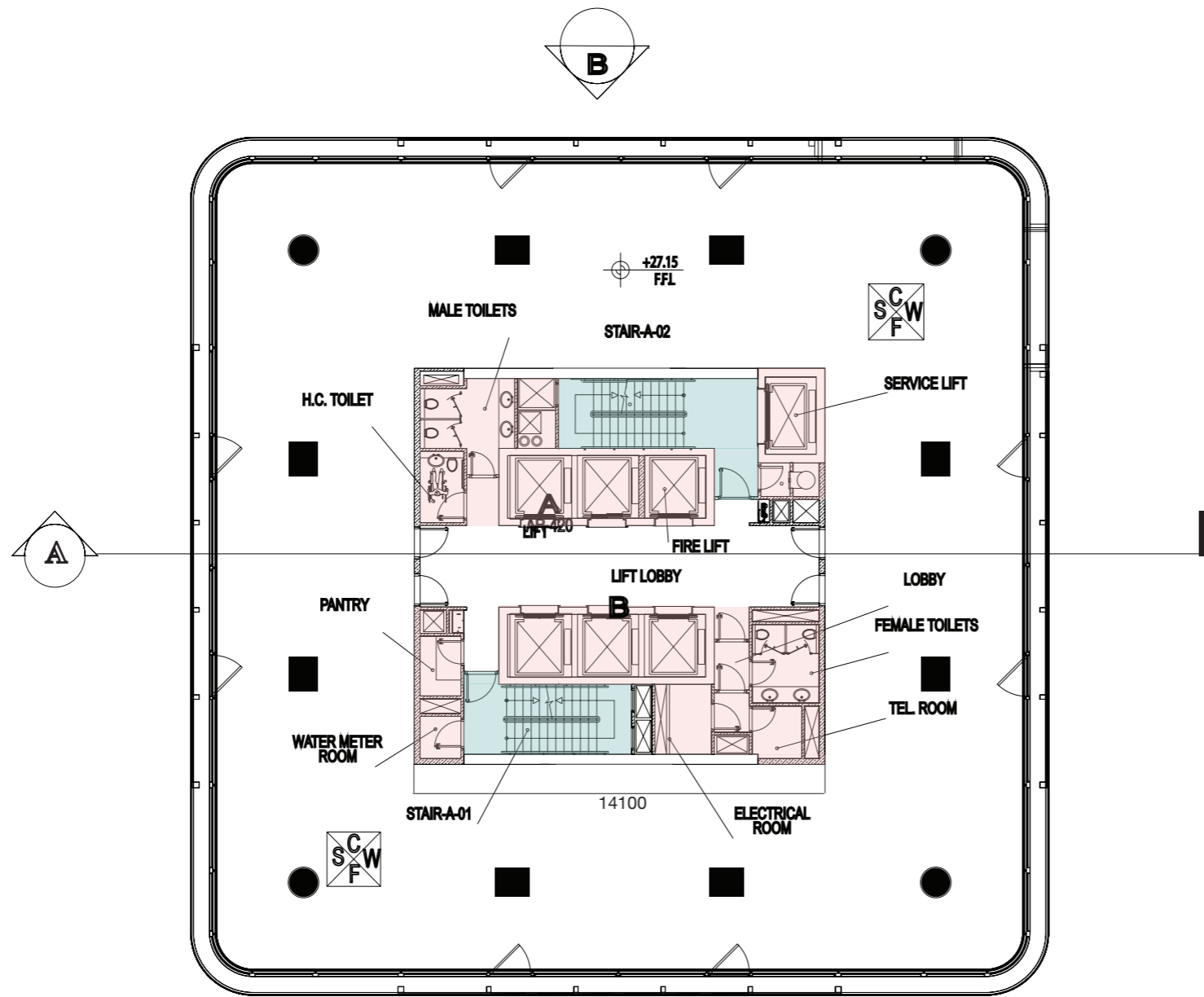
Fig. 44,45,46 Images showing the different views from different directions

Healthcare spaces with views of nature, offer support that is therapeutic and could possibly have a positive effect on the physical and psychological well-being of the patients.



Poetic lighting is created in areas which have the square forms in the facade. These create beautiful shadows which change their location with the sun direction. (see fig 47)

Fig. 47
Images showing forms in in the facade creating poetic lighting



Service areas
 Exits

Placing all service areas at the core of the building allows for uninterrupted floor area which gives the opportunity for easy dividing the space based on need. However, The position of columns might be considered a design challenge when designing the clinics.

Fig. 48 7th Floor Floor Plan



Service areas
 Exits

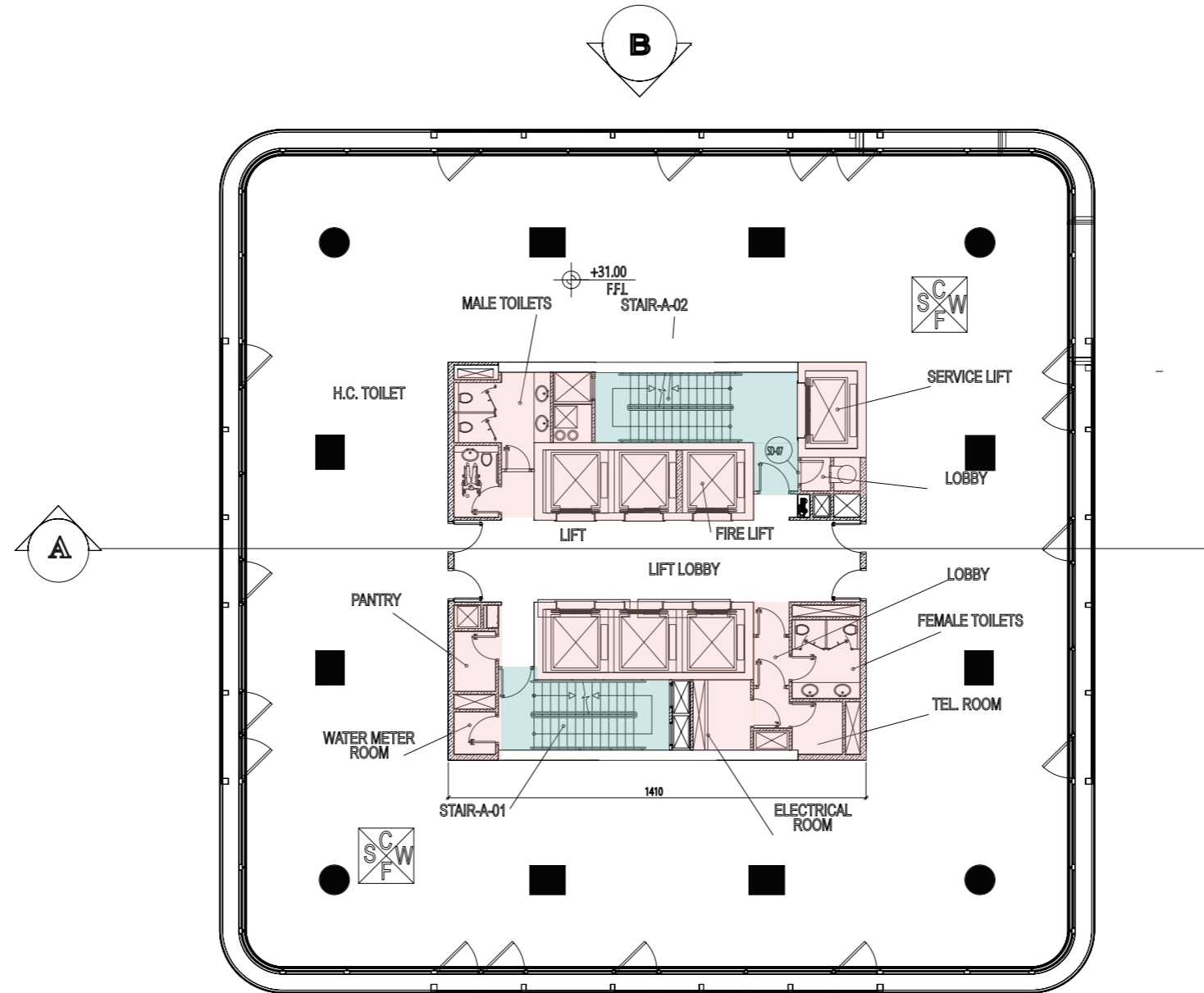


Fig 49 8th Floor Floor Plan



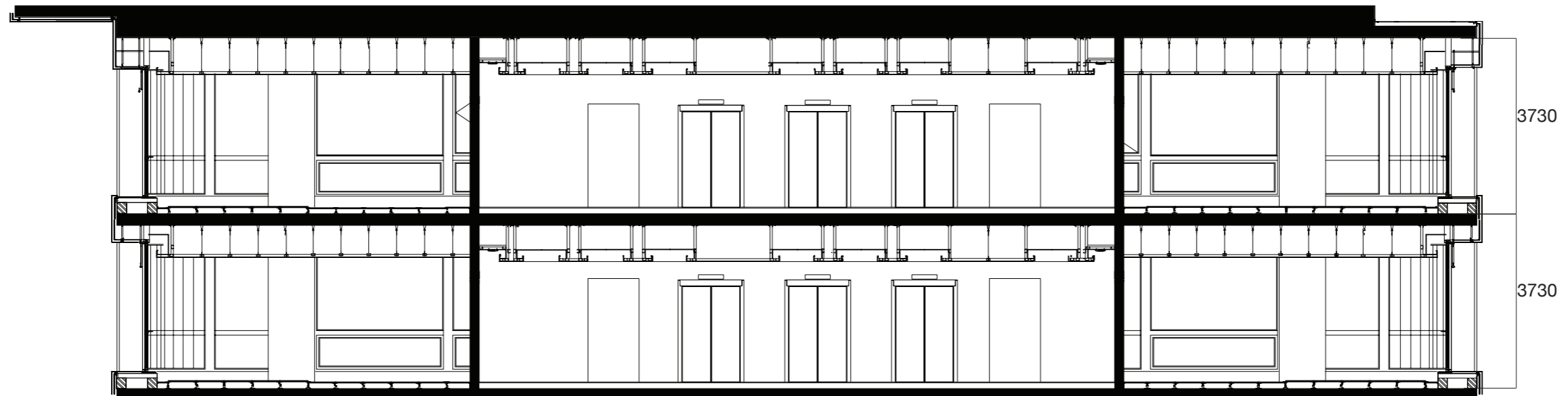


Fig 50 Section A



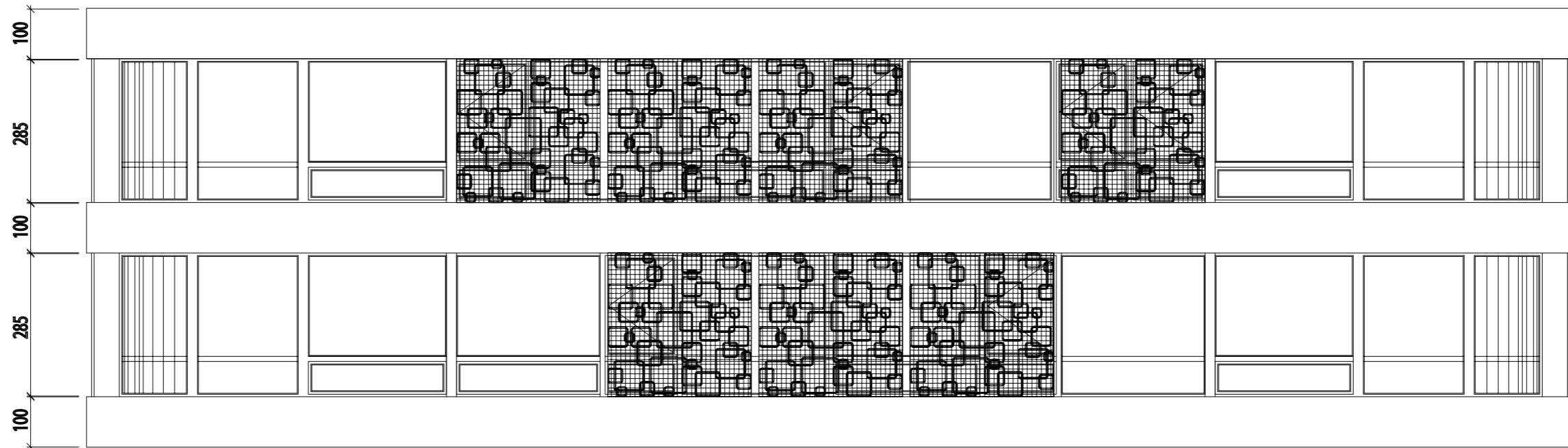


Fig 51 Elevation B



Concept Statement

A serene environment designed to evoke a sense of tranquility for oral health patients especially those with dental anxiety.



Just like how an oasis provides **refuge, relief** and a **pleasant experience** to the travellers across the desert, the dental oasis will provide its patients feeling of **safety, comfort** and **positive distraction** through their times of distress. The project took inspiration from Qatar's desert topography.

Conceptual Framework

Dental anxiety is defined as an exaggerated fear which occurs during the dentist visit; this can be in the case of preventive care as well as undergoing a procedure. It affects the person on physical, psychological and social levels.⁵³ On a global scale, dental anxiety affects 13% to 24% of the people, making it a common problem.⁵⁴ The proposal aims to provide a serene environment that induces a sense of tranquility for oral health patients, especially those with dental anxiety. Since the patient's perception of the environment has a significant impact on their overall healthcare experience ⁵⁵, a theory from environmental psychology will be chosen to be guide the design decisions to achieve the required proposal, in attempt to make the patients visits less daunting. The theory chosen is biophilia. Biophilia theorizes that human beings have an innate connection to nature; it has turned into a well-researched methodology, which utilizes the positive experiences from natural components in the design of constructed environments, like the dental office.⁵⁶

Biophilia has a positive impact on human health. Restorative effects triggered by being in nature, such as lowering blood pressure which leads to a better emotional state. Stress hormones' levels are also lowered ⁵⁷. According to Ulrich, "exposure to nature could reduce negative emotions and foster recovery from physiological stress and health problems."⁵⁸ Fourteen patterns have been classified as biophilic patterns. They are further categorized into three separate groups: nature in the space, natural analogues and nature of space. There are multiple subgroups under the three groups.⁵⁹

Nature in the Space

Nature in the space pattern includes the physical, transitory, and direct existence of natural components in a place or space. It breaks down into seven sub-groups, which are: Visual Connection with Nature (which includes a view of elements of nature), living systems and natural processes , Non-Visual Connection with Nature (relying on the senses of hearing, smell, touch or taste), Non-Rhythmic Sensory Stimuli (random and temporary connections to nature), Thermal and Airflow Variability (slight shifts in temperature, humidity or airflow), Presence of Water, Dynamic and Diffuse Light (variable light and shadow intensity over time), and Connection with Natural Systems (awareness of the change in natural processes).

In the design, various natural elements will be used in the space. Different types of vegetation will be added in different areas to imitate the relaxing feeling of being in an oasis. In addition, a water feature will be running along the core of the building to soothe

the patients on their way to the clinics. Essential oils will be infused in the waiting area to stimulate the sense of smell which is proven to decrease anxiety. Moreover, playing music of natural sounds will be used as a masking sound in the waiting areas and the clinics to alleviate patients' stress.

Natural Analogues

Natural Analogues target organic, non-organic, and indirect recreations of nature. There are three sub-patterns, which are: Biomorphic Forms and Patterns (utilizing organic forms, natural textures, patterns and contours), Material Connection with Nature (using local ecology elements), and Complexity & Order (using natural rich sensory information to create interest).

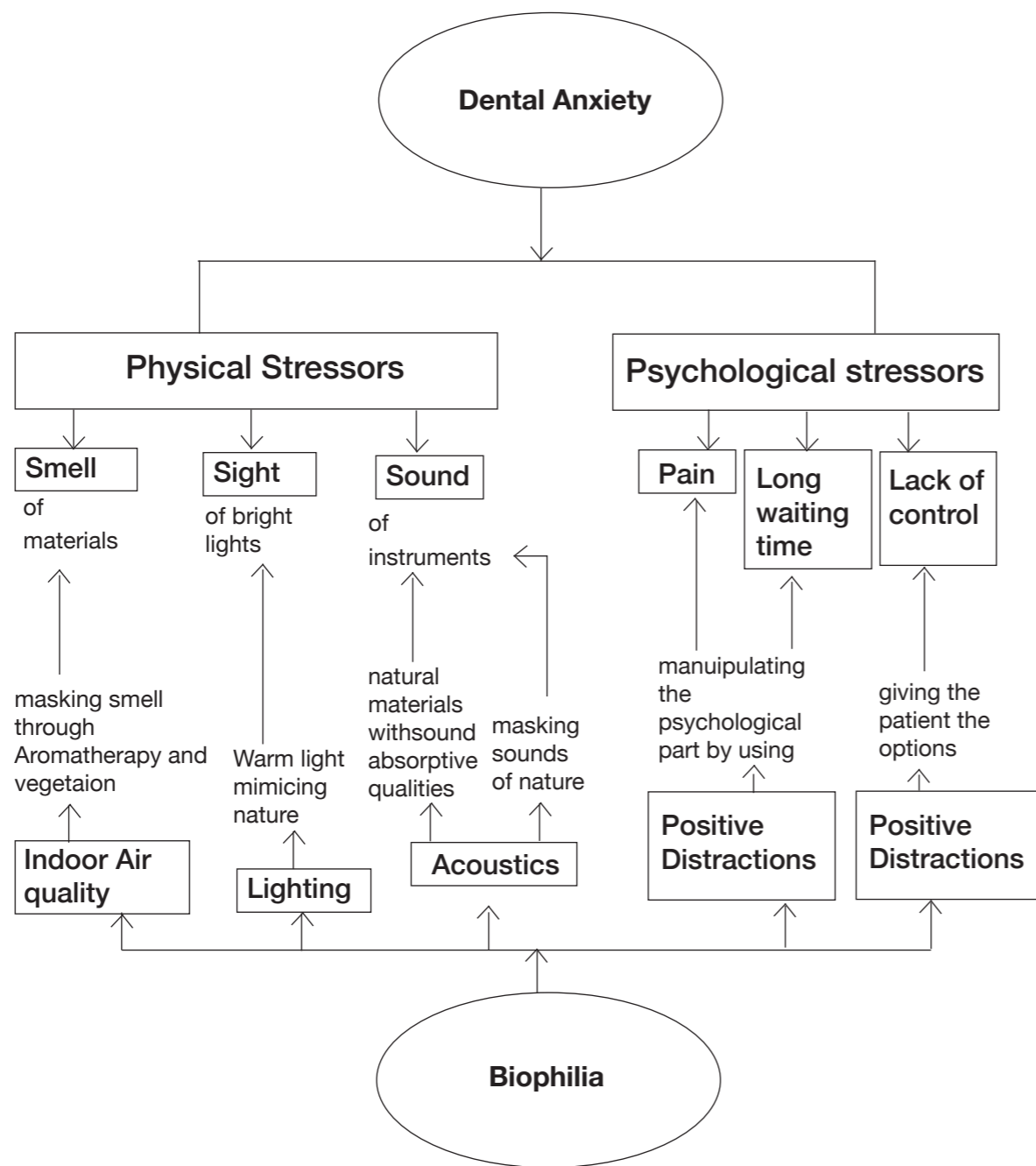
Natural patterns will be used in the clinic areas where natural vegetation can't be used. Illustrations of natural elements will also be used be as a wayfinding method to indicate the location of different rooms. In addition, natural materials like wood will be used to create the feeling of warmth in the waiting areas, where materials like vinyl will imitate the look of wood in the clinic areas to create the same warm feeling while taking advantage of its antibacterial properties.

Nature of the Space

Nature of the space targets natural spatial settings. They are further divided into four sub-patterns, which are: Prospect (creating a clear unobstructed view), Refuge (invoking safety), Mystery (provokes curiosity) and Risk/Peril (a threat connected to a dependable safeguard to create excitement).⁶⁰

The feeling of refuge in the space will be created by designing different ceiling heights in the areas where patients need to feel protected. These areas include the waiting area and the doctor's office. A designated area acting as a stimulus shelter will also be provided in case patients got overwhelmed and need to take a break away from the clinic.

Stressors in the dental environment are sensory and psychological in nature. The sensory stressors include distinguishable sights, smells and sounds of a dental office ⁶¹; caused by are the drilling sounds and patients crying in anguish, the distinct smell of eugenol, high frequency vibrations and sensations emanating from the dental handpiece ⁶². While the psychological stressors include pain anticipation ⁶³ and lack of control ⁶⁴.



The use of the healing power of nature to distract from the dental environment stressors would be quite helpful and calming to the patients. These natural distraction elements will be used in their natural and synthesized forms both in the waiting and treatment areas of the clinic. (See diagram fig 52)

Fig. 52 Diagram of conceptual framework

Acoustics

Sounds that are disturbing, loud, or unpleasant are grouped under the term, noise. In a dental office, noise can have a negative impact, as it can create annoyance and stress, disrupt communication, or may even be the reason for hearing loss. All of the former has a negative effect between dentist and patient.⁶⁵ While hearing loss may not be a problem for the patients, as are only exposed to the noise for a short period during their treatment, there are multiple indications relating it to dental anxiety, as it results in patient discomfort. On the other hand, noise is considered as a prevalent occupational hazard to the dentists.

Noise sources in the dental environment are not limited to the dental instruments only; they also include crying children, social conversations, air conditioning, computer sounds, building facilities, as well as broadcasting systems. Sound level were measured at maximum to be 85.8 dB and 92 dB in dental offices and laboratories respectively.⁶⁶ Thus, in this proposal, the acoustic design must be considered carefully to create a less stressful environment. This can be done by considering the acoustic requirements of each section and producing design solutions accordingly.

Reception desk

The first space encountered when visiting the clinic is the reception desk. Reception desk is the place where the patients will check in and discuss payment and insurance matters with the receptionist or with an admin. To allow for speech intelligibility and speech privacy, sound absorption will be achieved through the use of sound absorptive finishes like the use of wood flooring and wood cladding on columns. In addition, the furniture of the waiting area will not be placed too close to the reception desk. (See fig 53)

Waiting area

The waiting area is the public space of the clinic. Sound absorption can be achieved by using sound absorptive materials for furniture (upholstered furniture) and floor (like wood). In addition, choosing acoustically treated curtains can be utilized to block noise in open spaces⁶⁷ and give the patients the sense of control if they want to open/close them depending on their preference. Another way is to use background music in the waiting area, as it has a positive effect on patients awaiting treatment, as it masks other environmental noise, which results in lower levels of fear.⁶⁸ Moreover, adding vegetation to the waiting area is another method of controlling acoustics as it decreases the reverberation time.⁶⁹

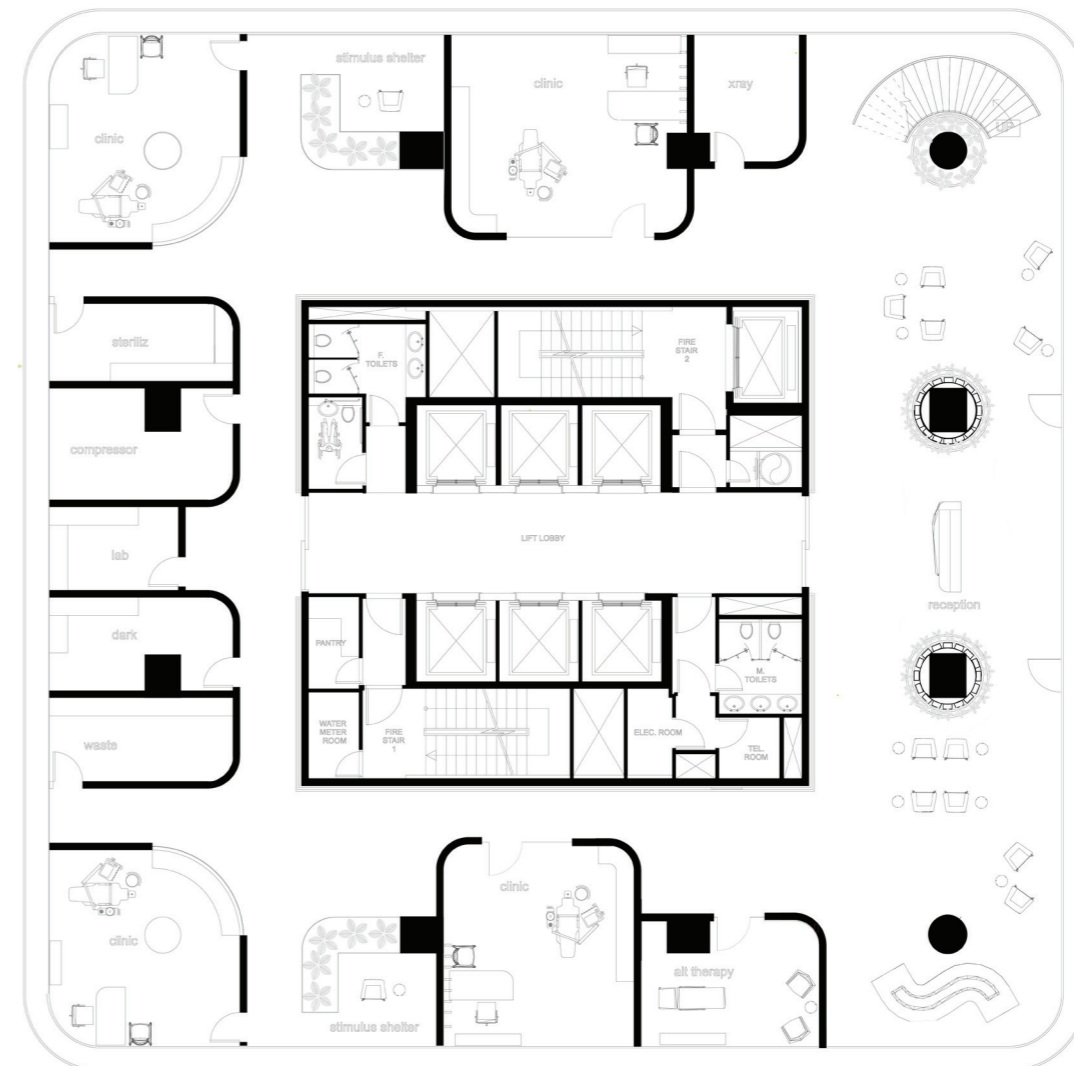


Fig. 53 showing ground floor plan
* NTS

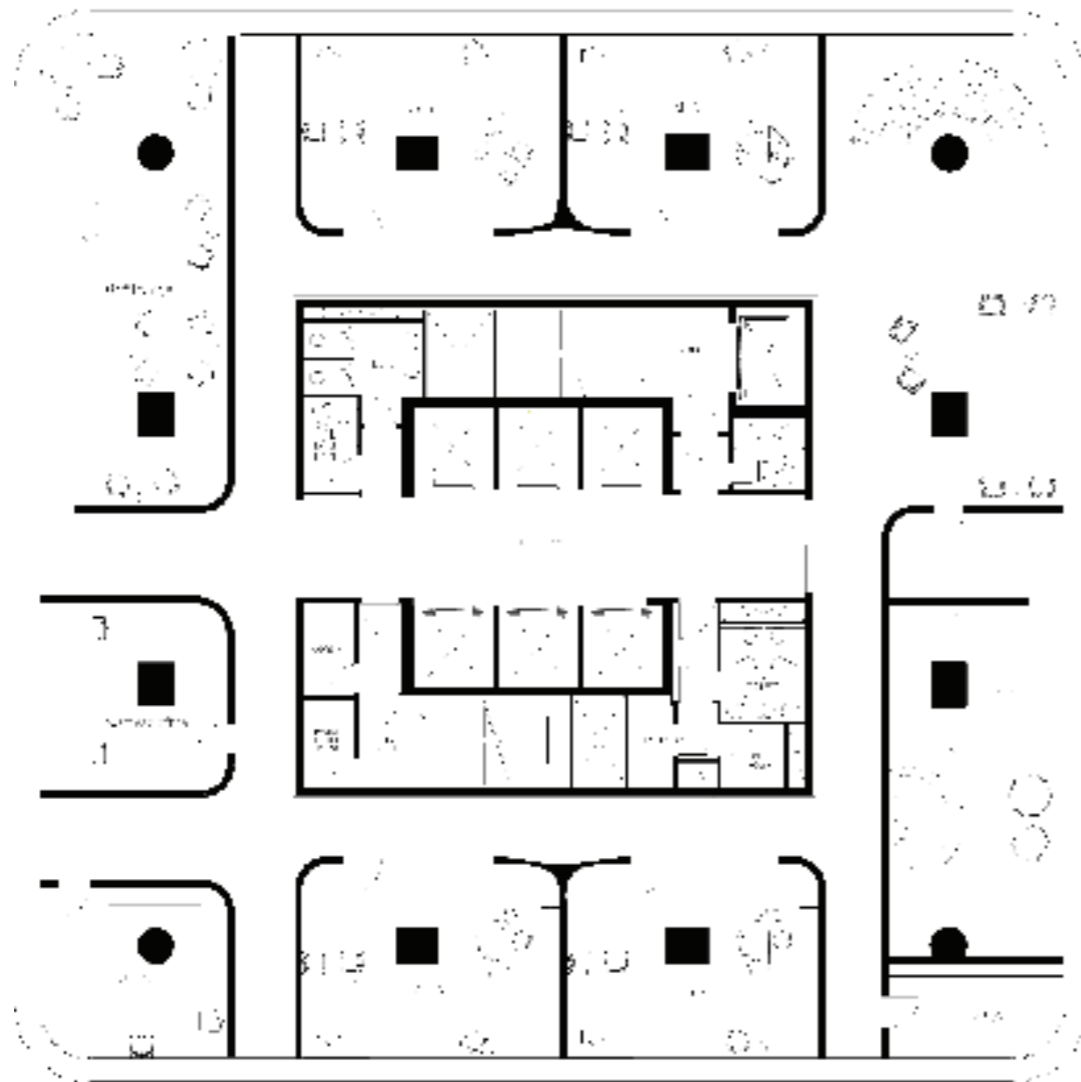


Fig. 54 Image showing first floor plan
* NTS

Treatment areas

In dental clinics, different instruments cause high noise levels with the highest noise produced by the ultrasonic-scaler (85.8 dB) and the lowest noise (49.7 dB). Occupational Safety and Health Administration (OSHA) has reported the daily permissible noise level of 85 decibels for 8 hours of continual exposure.⁷⁰ To reduce noise, incorporating a suspended acoustical ceiling system with acoustical ceiling tiles (Act) to promote a satisfactory acoustic environment will be useful. In addition, Penetrating the ceiling membrane is the most effective way of reducing noise transfer between spaces ⁷¹

Playing music in the treatment areas is linked to decrease anxiety in patients ⁷², thus a sound speaker will be added where patient can choose their preferred music which also enhances their sense of control. In addition, finishes like wood will be used in the doctor's office area to give a warm feeling and aid in sound absorption. Sound can be reduced also by using instruments that produces low sound emissions. Dentsply Sirona the world's largest manufacturer of dental products, announced the production of low emission sound contra-angle handpieces and turbines ⁷³.

To create a more open feeling for the space, soundproof glass walls will be used between the clinic and the corridor to allow daylight in the space and minimize "the corridor feeling" this can be done by using 12mm double glazed glass which has a 46 acoustical insulation value.⁷⁴

Corridors

Using sound absorptive materials in the corridors will result in reduced noise exchange in-between spaces. ⁷⁵ The use of wood will be continued from the reception to the corridors. Acoustic ceiling tiles will also be used to absorb sound.

Alternative therapy room

Alternative therapy methods have been one of the methods to decrease dental anxiety.⁷⁶ To ensure speech privacy in enclosed rooms, floor-to-slab rooted walls are fitted, which have a minimal rating of 40 on the STC scale. This creates a relaxing quiet environment for patients and ensures speech privacy. ⁷⁷

Xray room, sterilization room, dental laboratory and mechanical room

The sound created by these machines can be reduced using acoustic ceiling tiles. In addition, the service rooms (sterilization, lab and mech) will be grouped together away from the waiting areas and clinics. This will decrease the transmission of sound to them thus decreasing patient anxiety.

Staff lounge

Dentists' working performance and satisfaction is directly prolonged exposure on the long term to noise in their office or working environment. The sharpness of such noises on the short term is directly related to dentists' experiencing symptoms on the physiological scale; such as irritation, nausea, headache, fatigue, tinnitus, and hypertension.⁷⁸ Thus, creating a space that is restorative space for them is important. In this semi-public space, conversations will be held during their break time. Sound absorption can be achieved by using acoustic ceiling tiles and vegetation.

Space planning

Placing the public areas together (female and male waiting areas) away from the clinics in both floors, decreases the sound transfer through them. In addition, placing the service areas (esp the dental lab which has the highest noise pollution) away from the rest of the areas, decreases the sound transfer to them. (See fig.53,54)

Indoor Air Quality

Indoor air quality is a reference to the quality of air in the premises of buildings and constructions, which relates to both the comfort and health of those occupying the premises. ⁷⁹ People are prone to conditions like Sick Building Syndrome (SBS), which may result from poor air quality. This syndrome describes a particular condition, when those occupying a building/ structure experience acute comfort/ health effect, which could be directly caused from time spent in a building's premises. ⁸⁰

Indoor air quality problems that need to be considered

Airborne particles

The generation of dust, aerosols, and particulates in the dentist's office is common with some standard dental procedures, which possibly could contain benign and pathogenic microorganisms, metals (such as mercury fumes), as well as other substances (like latex allergens and silicone dust). A number of healthcare establishments apply both detergent and cleaning solution to lower infection risk, while inadvertently raising levels of Total Volatile Organic Compounds (TVOCs). Currently, only limited solutions are available when it comes to the nature, persistence or level of the bio-aerosols and/or particulate pollution in dental environments. ⁸¹

Humidity

Uncontrolled moisture levels can be a problem to the building structure, as well as the furniture and the other finishes like floors, walls and ceilings. In the proposal, a water feature will be used as a biophilic element to reduce patient's anxiety. In general, mold is not usually unless there is excess moisture in the space. ⁸²

Solutions that can be adopted

Materials

Specifying materials and finishes of anti-microbial nature (like Vinyl sheets and Corian in working areas) to the highest possible extent. In addition to minimizing floor seams and finishes in the walls. While limiting aggregating dust through evading horizontal surfaces, which do not serve a working purpose. ⁸³ However, these materials will be selected to mimic the look of natural materials to go with the concept of being in an oasis.

HVAC

Poorly ventilated dental treatment environments are fertile spaces for aerosol buildup. Combining PAC (portable air cleaner) and HEPA (high efficiency particulate air) filtration has a significant impact on reducing aerosols aggregation, while accelerating its removal.⁸⁴ In addition, Airborne microbe levels could possibly be diluted through high ventilation rates and maintaining air ventilation and conditioning systems. According to ANSI/ASHRAE/ASHE Standard, maximum relative humidity should be 60% in clean rooms with a temperature ranging from 72 to 78 Fahrenheit (22-25.5 c), while dirty rooms have no humidity requirement.⁸⁵

Indoor potted-plants

Indoor plants have displayed the ability to clear the common forms of air-borne contaminants, those that arise from both indoor and outdoor sources alike. Enclosed environments with indoor potted-plants have shown through studies to improve the wellbeing of the occupants while reducing sick leaves by around 60% ⁸⁶. Indoor Plants will be used in the waiting areas not only to purify the air, but also as a biophilic element in the space. (See fig.56)

Natural ventilation

High rate of air change is prohibited in health-related environments (such as clinics and hospitals) for infection control, which in-turn limits natural ventilation despite its aid in air cleaning. Ceiling fans functioning to remove air as well as air-suction tubes help when their installation is close to dental chairs; HVAC systems also play a role. ⁸⁷

Waste

In the treatment room, enough storage must be provided for disposables, and space for special waste containers must be located in the treatment rooms. These containers are lined with plastic bags that can be sealed before disposal. In some states, a separate storage area that is usually placed near the staff or service entrance is needed for biohazardous waste are kept until certified haulers gets rid of it ⁸⁸. In the proposal, a room will be used for waste collection. It will be placed near the service entrance.

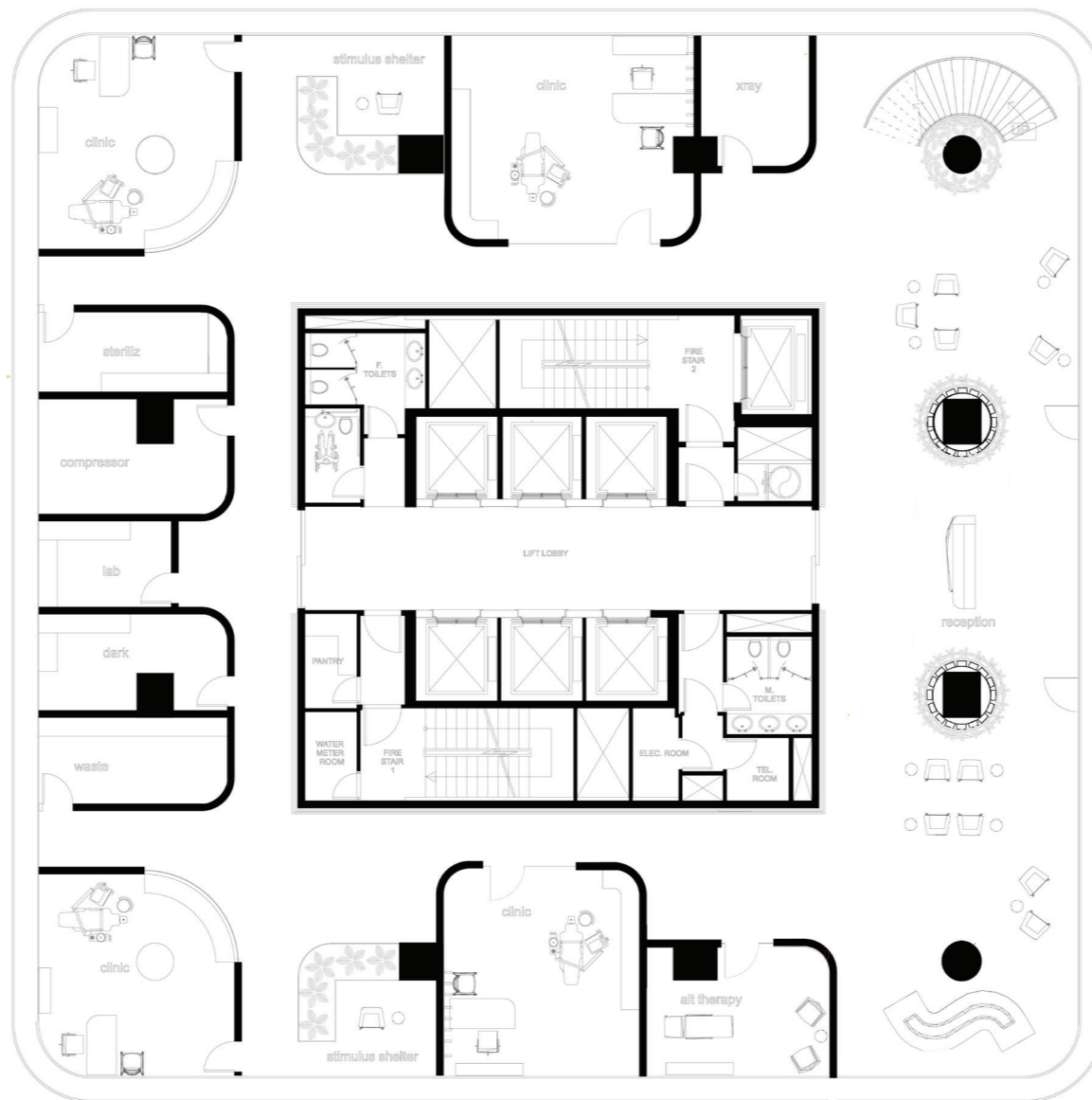


Fig. 56 Image showing the use of potted plants in the waiting area of the ground floor
 * NTS

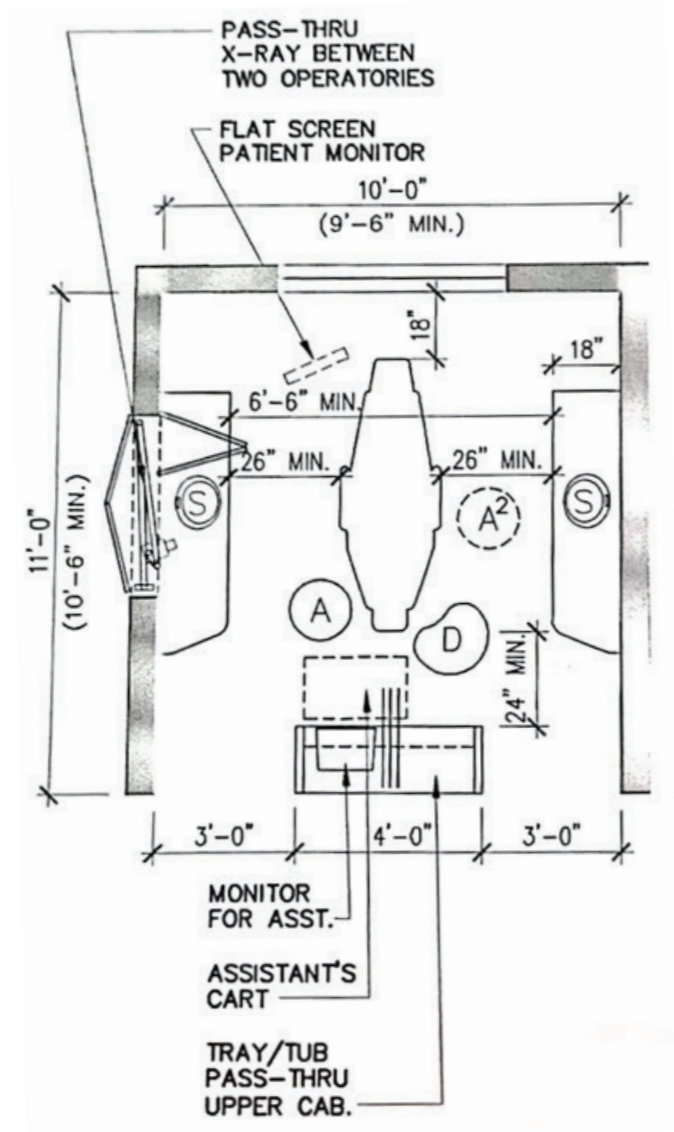


Fig. 57 showing the minimum spatial requirements around the dental chair

Ergonomics

Applying ergonomics successfully in a dental environment guarantees high levels of productivity, increased satisfaction for the parties involved, as well as avoidance of both injuries and illnesses. Prevalent disorders and issues within the dental community such as musculoskeletal disorders, are aimed to be prevented through good ergonomic design. Awkward postures, repeated movements, working time, forceful exertions, and contact stresses are all common risk factors; this is because of continuous or repetitive contact with sharp and hard tools, vibrations as well as psychological causes. An example can be performing very fine surgery, without having enough time to rest or divert. There are four factors directly related to the level of risk, and they are, the frequency, intensity, and time of exposure.⁸⁹ The design will consider physical and cognitive ergonomics to create a safe and convenient space for both the patients and the dental staff in the dental environment.

Physical Ergonomics

1-Spatial requirements

The treatment rooms should allow enough workspace for the dentist and the assistant. According to Malkin, the minimal space required between the cabinets and the dental chair is 660 mm (26") and 457 mm (18") and 609 mm (24") between the sides, end and head of the chair respectively. This space ensures enough space for the dental staff to move around and work efficiently.⁹⁰ (See fig.57)

2-Lighting

The ratio of intensity between ambient lighting of the room and task lighting (dentist's work light) shouldn't exceed 3 to 1.6. This prevents "optical bounce" which results from the continual opening and shut of the iris of the eye due to extreme differences in brightness. Optical bounce results in headaches and eyestrain. In spaces designed for treatment, fluorescent lamps of the full spectrum should be used. They should have CRI 90 or more, while color temperature should be 5500 which is required for correct tooth filling shade matching.⁹²

3-Proper Temperatures

A dentist's finger temperature can become low due to the contribution of low room temperatures and using cold instruments/materials. A standard finger temperature cannot be defined, but to maintain a capable grip and dexterity, the temperature should not drop below 25 C (77 F).⁹³ By specifying dental chairs which have a heating option, patients can

achieve a sense of comfort in case they feel cold, which might result as one of the anxiety symptoms.

4-Odor

Aromatherapy will be used in the waiting areas. It will be used to mask the dental materials' scents and create a relaxing effect in patients before getting their dental procedure done. Aromatherapy is a proven means which reduces dental anxiety.⁹⁵

5-Color

Using a lower saturation color pallet has a calming effect on the anxious patients, as the average arousal ratings are linked to highly saturated chromatic colors than for colors with medium or low saturation.⁹⁶ In the treatment rooms, lighter color cabinets will be used as it is much harder to see dirt on dark cabinets which makes them harder to clean. In addition, decreasing the contrast in the treatment rooms is important to decrease eyestrain.⁹⁷

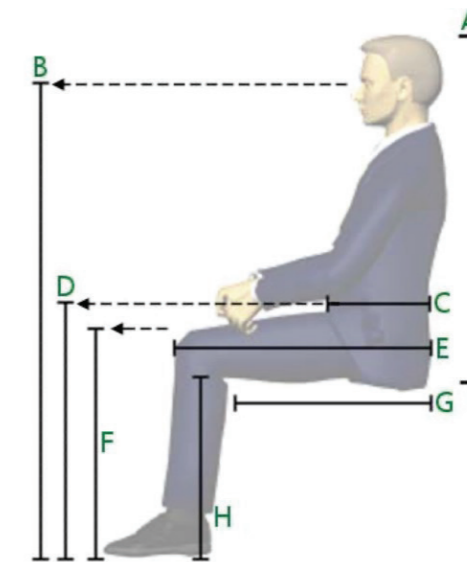
6-FF&E

Furniture :

Waiting areas should provide comfortable seating for the visitors. Furniture measurements are based on the average adult anthropometry (See fig 58).⁹⁸ In addition, Furniture will be placed facing the curtain walls in both the treatment rooms and the waiting areas to allow looking at the natural views. Viewing nature through windows can help people recover from mental stress and it is the preferred by patients visiting healthcare facilities.⁹⁹ In the waiting areas, both sociofugal and sociapetal arrangements will be provided to cater for the different preferences of the patients. In the kids waiting multisensory room, bean bags will be used to accommodate for different ages.

Materials:

Materials that are easily cleaned should be selected for healthcare environments. Surfaces should be seamless to facilitate their cleaning. Window treatment PVC vertical louvre blinds which come in roller shade or roman shade can be used because they are easy to clean. They can hide the sun without obstructing views, as well as reducing heat gain in the south and west. (Manufacturers: Solar shades and mechanical shades).¹⁰⁰



Measurement	Letter	Female 5th – 95th%	Male 5th – 95th%	Overall Range 5th – 95th%
Sitting Height	A	31.3" – 35.8"	33.6" – 38.3"	31.3" – 38.3"
Sitting Eye Height	B	42.6" – 48.8"	46.3" – 52.6"	42.6" – 52.6"
Waist Depth	C	7.3" – 10.7"	7.8" – 11.4"	7.3" – 11.4"
Thigh Clearance	D	21.0" – 24.5"	23.0" – 26.8"	21.0" – 26.8"
Buttock-to-Knee	E	21.3" – 25.2"	22.4" – 26.3"	21.3 – 26.3"
Knee Height	F	19.8" – 23.2"	21.4" – 25.0"	19.8" – 28.0"
Seat Length/Depth	G	16.9" – 20.4"	17.7" – 21.1"	16.9" – 21.1"
Popliteal Height	H	15.0" – 18.1"	16.7" – 19.9"	15.0" – 19.9"
Seat Width	Not Shown	14.5" – 18.0"	13.9" – 17.2"	13.9" – 18.0"

Fig. 58 Image showing furniture dimensions requirements

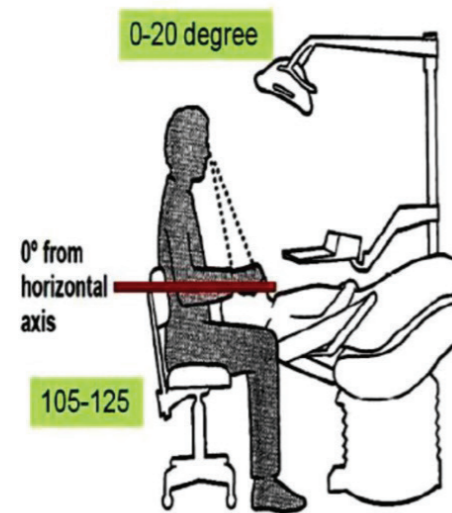


Fig. 59 Image showing the doctor's chair requirements

In the treatment room, the dentist's chair should allow a 105 to 110 degrees angle between the upper and lower leg, with soles resting on the floor. The upper part of the body should be perpendicular on the chair.¹⁰² (See fig. 59)

Cognitive Ergonomics:

1-Mental workload

One strategy to reduce musculoskeletal problems is to take rests after each care session and long coffee or lunch breaks.¹⁰³ As a result, the design will include a relaxing staff lounge where dental professionals can take a break and restore their refocus.

2-Way finding

Because healthcare facilities are known for their high levels of anxiety and emotional strain, the route and navigation aspect should be clear from the moment a patient enters the institution until the patient exits. In the design, a reception desk is placed in front of the entry door and will be the first thing the patients see when they first walk in. This not only welcomes the patients creating a warm feeling, but also to guide them and give them instructions on what do to and where to go. The circulation is clear and linear around the building's core. Signage, contrast and architectural features will be used to differentiate important areas. This was the best way for wayfinding according to a study which compared virtual environments to create three distinct wayfinding design conditions:

- Condition A: Standard signage and minimal contrast between the destination, the signage, and the overall environment are used
- Condition B: color was used to highlight destinations
- Condition C (Enhanced Color, Graphics, and Architectural Features): both color and architectural features are used to differentiate the space ¹⁰⁴(See fig 60)

3. Privacy

“According to HIPPA, The Privacy Rule applies to all forms of individuals’ protected health information, whether electronic, written, or oral.”¹⁰⁵ In the design, only one patient will be treated in each room, and each treatment room will be acoustically treated so that information will not be heard outside.

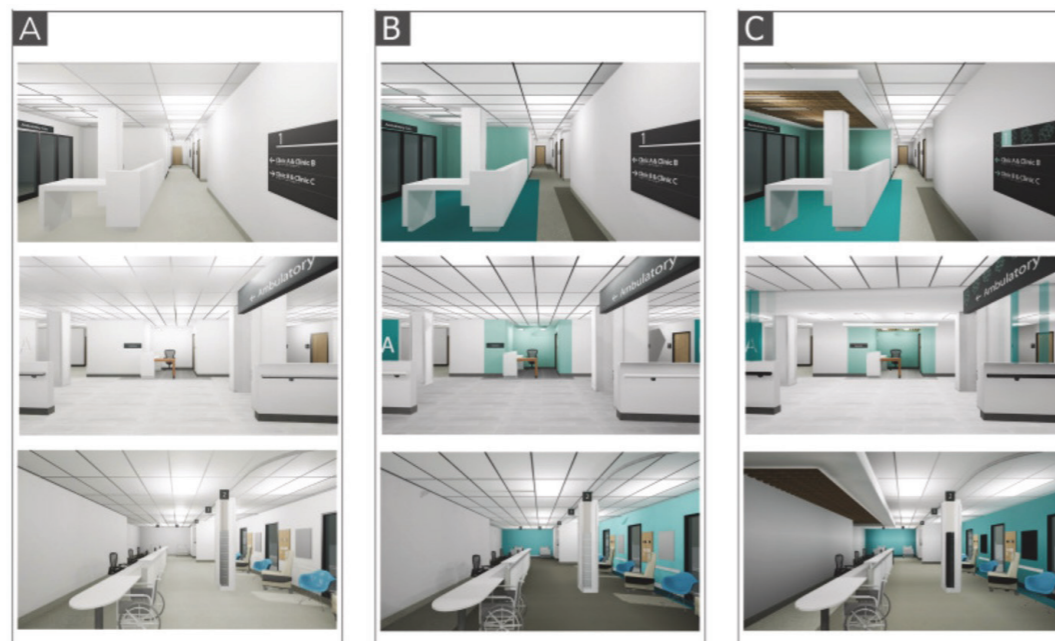


Fig. 60 image showing 3 diff virtual reality wayfinding methods

Light

Humans' daily lives are affected by multiple factors, light being one of them. Its type and amount have a direct effect on mood, concentration as well as other aspects. The human body is also affected by the light's color temperature. ¹⁰⁶ Creating an atmosphere in medical environments, which is perceived as interesting by the patient, highly depends on lighting; which is critical in guarantying confidence for those who enter the space. ¹⁰⁷ Thus, in the design, different lighting strategies will be used depending on the needs and aesthetics required in the space.

Reception and waiting area

Abundant natural light will be used as a biophilic design element in the space, taking advantage of the Eastern glass façade. Exposure to natural daylight is known to enhance mood due to increased serotonin levels ¹⁰⁸ which will help relax the patients before their treatment. The shadows created by the forms of the façade will create variable light and shadow intensity over time as the sun changes its position creating dynamic light which is also one of the biophilic principles. ¹⁰⁹

As for the artificial lighting, it will be designed in layers (ambient, accent, decorative, task) to create an esthetically pleasing space, creating several points of interest that stimulate the sense of sight. Ambient light will be used on ceilings and columns highlighting the geometries used. While accent light will be used on the vegetated areas drawing the patients' eyes towards them. Warm lighting will be used throughout the space, 2000K-3000K to make the environment feel more welcoming and relaxing. ¹¹⁰ (see fig. 61)

Corridors

Making sure that color temperature in the rooms and the corridors flow into each other is a must. If the difference between the type of lamps and their color temperatures is noticeable, it creates visual disharmony. ¹¹¹ Therefore, a gradient of light increasing in strength from the waiting room to treatment areas will be used. Light temperature of 3500-5000K will be implemented. To facilitate wayfinding, banding light will be used in the corridors creating a wall wash effect on the textured wall creating visual interest.(See fig 62)

Treatment areas

Natural light: All treatment chairs will be placed facing the glass façade to take advantage



Fig. 61 Sketch showing types of light in the space.
1- ambient 2- natural sunlight 3- accent

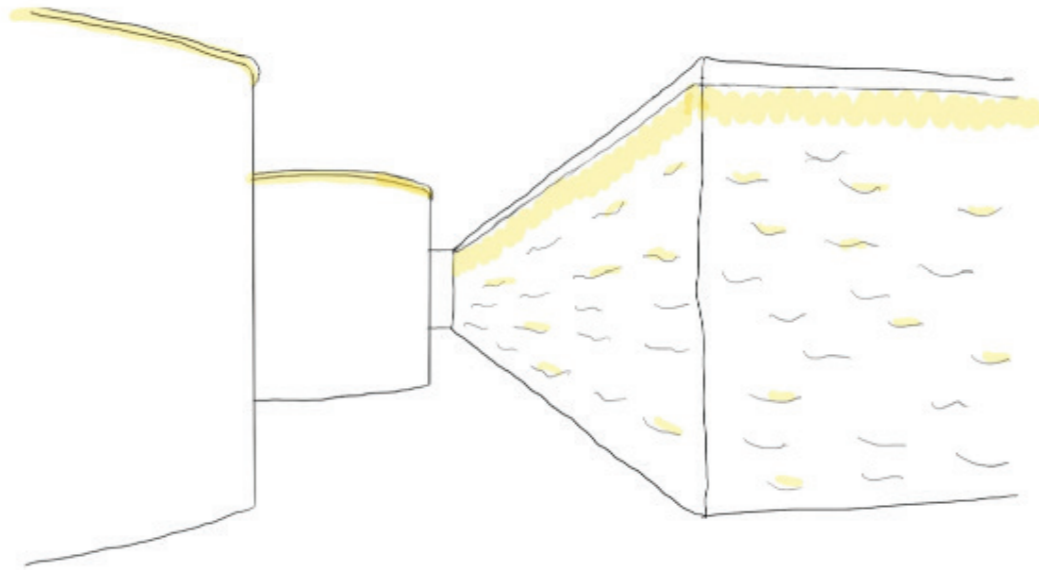


Fig. 62 scetch showing the use of banding light as a means of wayfinding

of natural lighting both in enhancing mood and shade matching. Dentists cannot depend on natural light for choosing the teeth filling material shade selection. Even though it is the ideal light source for that, the quality of daylight is inconsistent resulting in a common inability to select shades during daytime.¹¹² Which is why the use of proper artificial light is important. To prevent glare during the day, roller shades that are especially designed for healthcare (prevent glare, do not block the view and can be disinfected), will be used to control the amount of light entering the space¹¹³

Artificial light: treatment rooms will be divided into two areas in terms of lighting. The doctor's office area and the patient's treatment area. In the doctor's desk area, relatively warmer light will be used to create a more intimate atmosphere as warm lighting tends to make people more relaxed. This is important while patients are discussing the treatment plan and signing the paperwork prior to the treatment.

In the treatment area, indirect light (COV) will be used which is aesthetically pleasant while keeping the glare away from the patients' eyes. The operatory light (dental chair's task light). fluorescent lights of CRI 90 or more, while its color temperature is 5500 kelvin are vital for appropriate dental filling materials shade matching. Illumination must be shadow-free with a ratio of brightness 4:1, or 10:1 at the bare minimum in-between the room's ambient light and the oral cavity's halogen light.¹¹⁴

In conclusion, light in the design will be used as an esthetic and functional element. Different lighting strategies will be implemented depending on the use of the space. This will be done through the careful choice of the type and color temperature needed. Thus, catering for the different psychological and functional needs of the different areas.

Building Codes

The primary goal of building codes is to establish minimum standards for the protection of public health, safety, and welfare in the construction and use of buildings and structures.¹¹⁵ In order to achieve a safe environment for the dental clinic users, it is important to consider the different code requirements for the space. This begins by first identifying the occupancy classification then applying the different codes required. Dental clinics are considered Business group B occupancy.¹¹⁶

Occupancy load

Occupant load is the “total number of people that might occupy a building or space at any one time. The occupant load reflects the maximum number of people anticipated to occupy the building rooms or spaces at any given time and under all possible situations.”¹¹⁷ Since Occupant load factor in Business Group B is 9.3 m² (100 sq feet) per person.¹¹⁸ Occupancy load = area/ occupant load factor = 568.5/9.3 m² = maximum of 61 people per floor
(Where the Area left = total area of building - core = (27.7*27.7) - (14.1*14.1) = 568.5 m²). Similarly, the area required for each room is calculated in the same way.

Room	Maximum number of occupants
Reception and waiting areas	12
Adult clinic	3
Stimulus shelter	1
Adult clinic	3
Alternative therapy	2
Dental lab, xray	1
Sterilization, dark	1
Multisensory waiting	5
Kids clinic	4
Manager's office	2
Business office	2
Storage	1

Egress

“A means of egress is a continuous and unobstructed way of exit travel from any point in a building or structure to a public way.” It consists of three parts which are: exit access, exit and exit discharge.

The exit access is “the portion of the means of egress that leads to an entrance of an exit”
The exit is the portion of the egress system that provides a protected path of access between the exit access and the exit discharge”

Exit discharge is the portion of the egress system between the termination of an exit and a public pathway”¹¹⁹

Since the maximum number of people per floor is less than 500, 2 exits are needed which are provided in the core of the building ¹²⁰

Minimum exit access travel distance with sprinkler system is 300 feet (91440 mm) ¹²¹. (See fig. 63,64)

Door and corridor widths

According to ADA, the space requirement is 30” to 48” for people with crutches. As for wheelchair users, a turning space for wheelchair is 1525 mm (60”) in diameter should be present. That's why the narrowest corridor width will be 1525 mm in diameter. All doors will be ADA compliant with a clearance of 914.4mm (36”) in width.¹²² (see fig. 65)

Spatial requirements

For the dental personnel, a minimum of 3 feet (915 mm) space must be provided along one side of the chair, the head of the chair, and between the cuspidor and the head of the chair on the other side. This space is required for the free movement of staff and increases efficiency.

Handwashing

A handwashing station must be included in each private dental clinic (An area that provides a hand-washing fixture, cleansing agents and means for drying hands)¹²³

Imaging

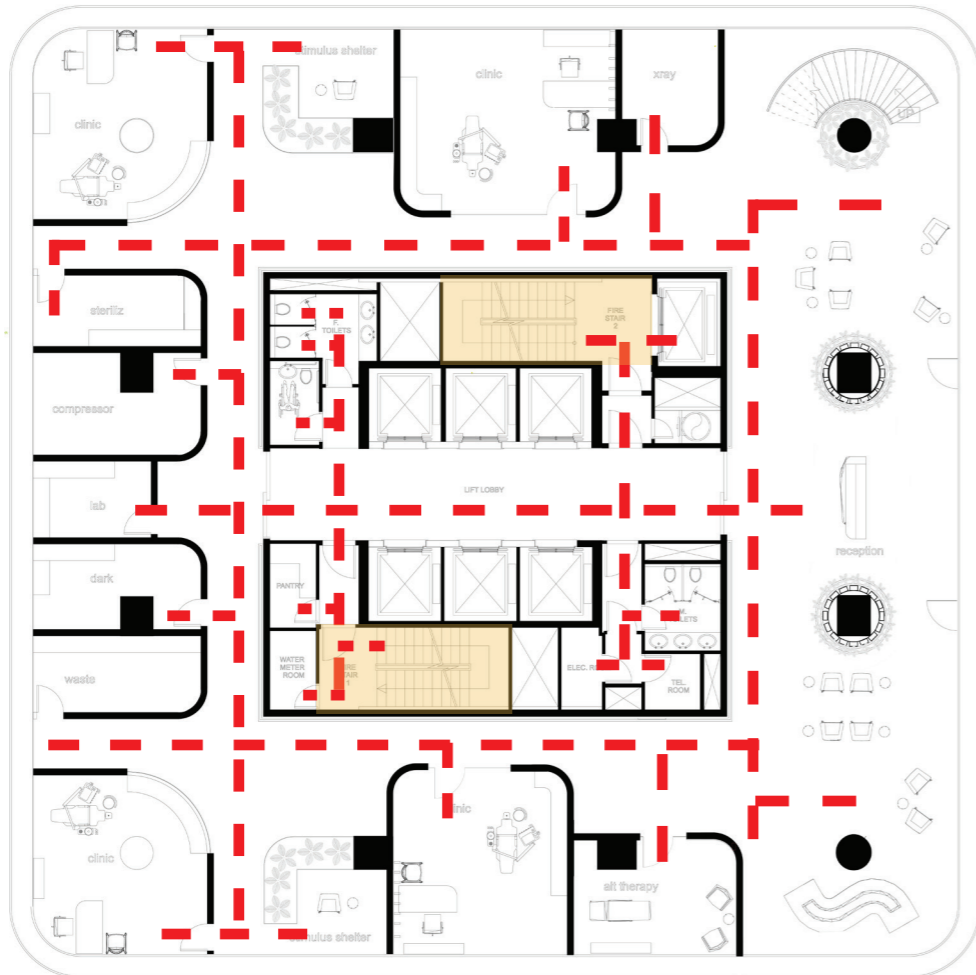


Fig. 63 image showing means of egress in ground floor

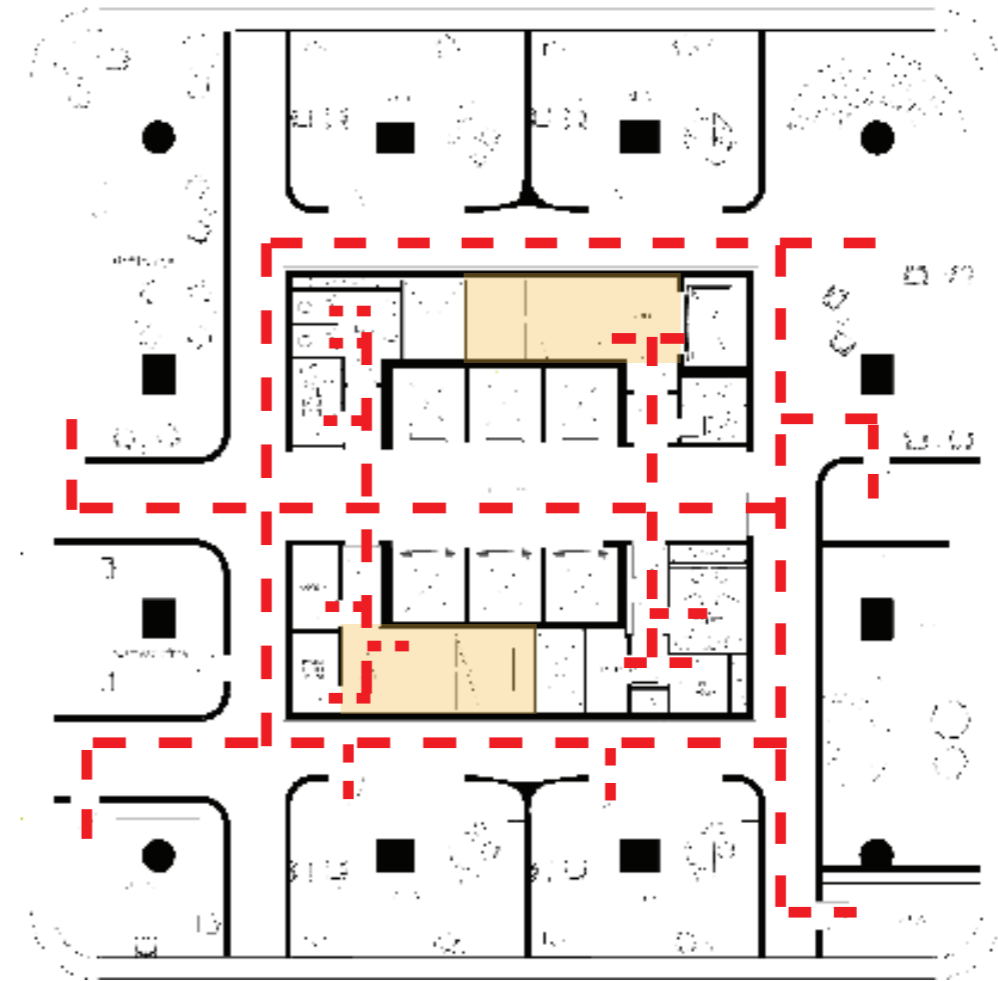


Fig. 64 image showing means of egress in first floor

Exit access
 Exit

Height requirements must comply with the type of panoramic x-ray machine used as they vary considerably according to each manufacturer.¹²⁴

In conclusion, applying these building codes will ensure the safety of the people using the dental clinic. Designating enough space for the occupants in each room allows for their safe egress in case of emergency. Meeting the spatial requirements regarding corridors and doors will ensure accessibility of all users, including wheelchair users. Finally, the careful design of working spaces will ensure efficiency of the staff and providing the best treatment possible.

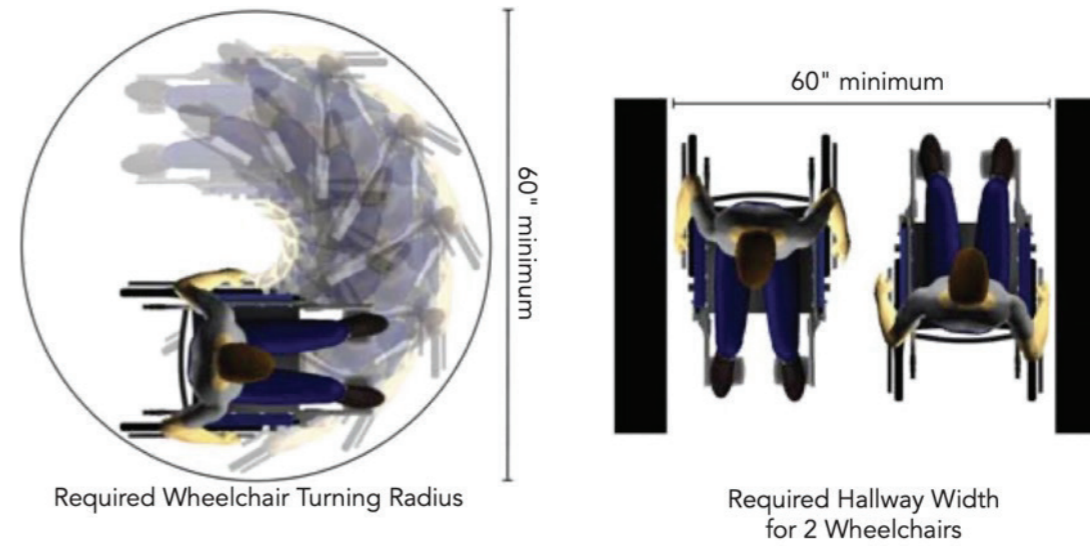
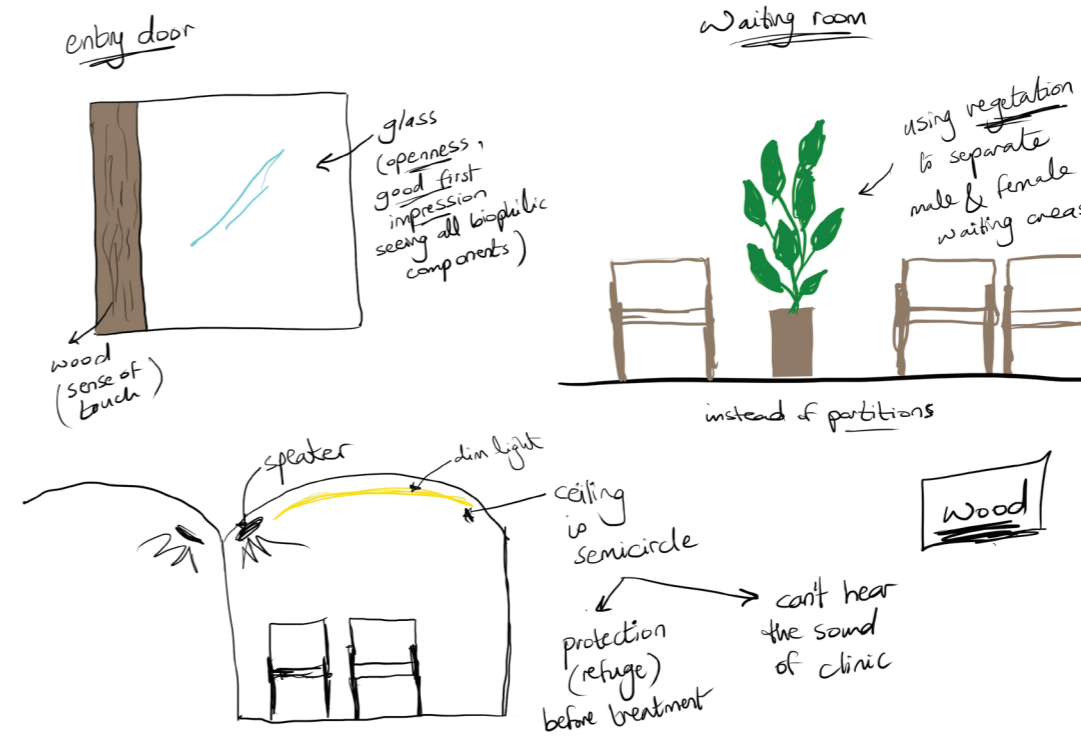
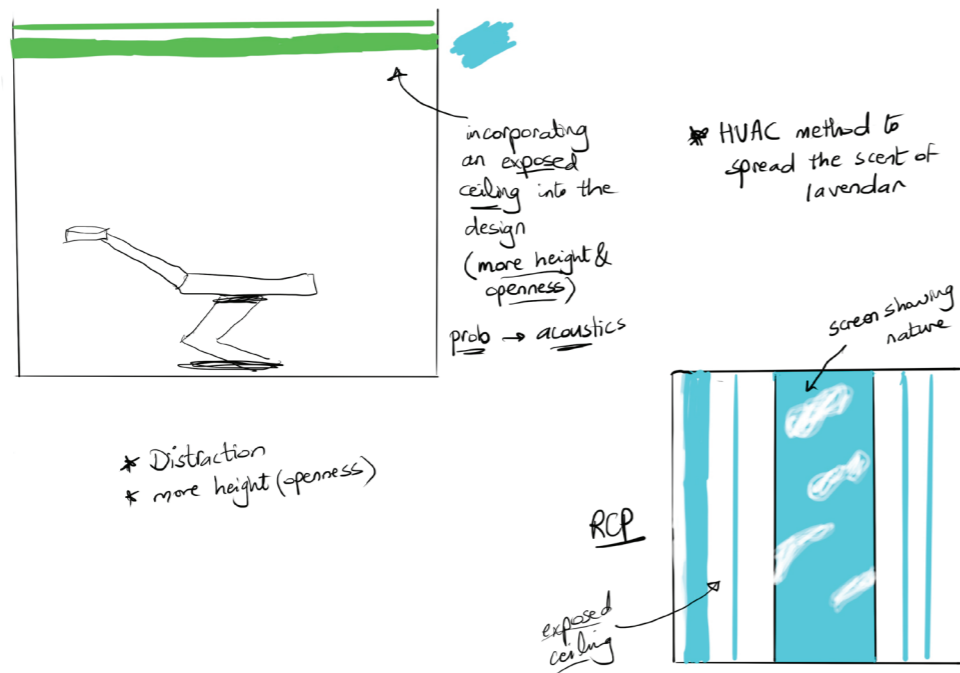
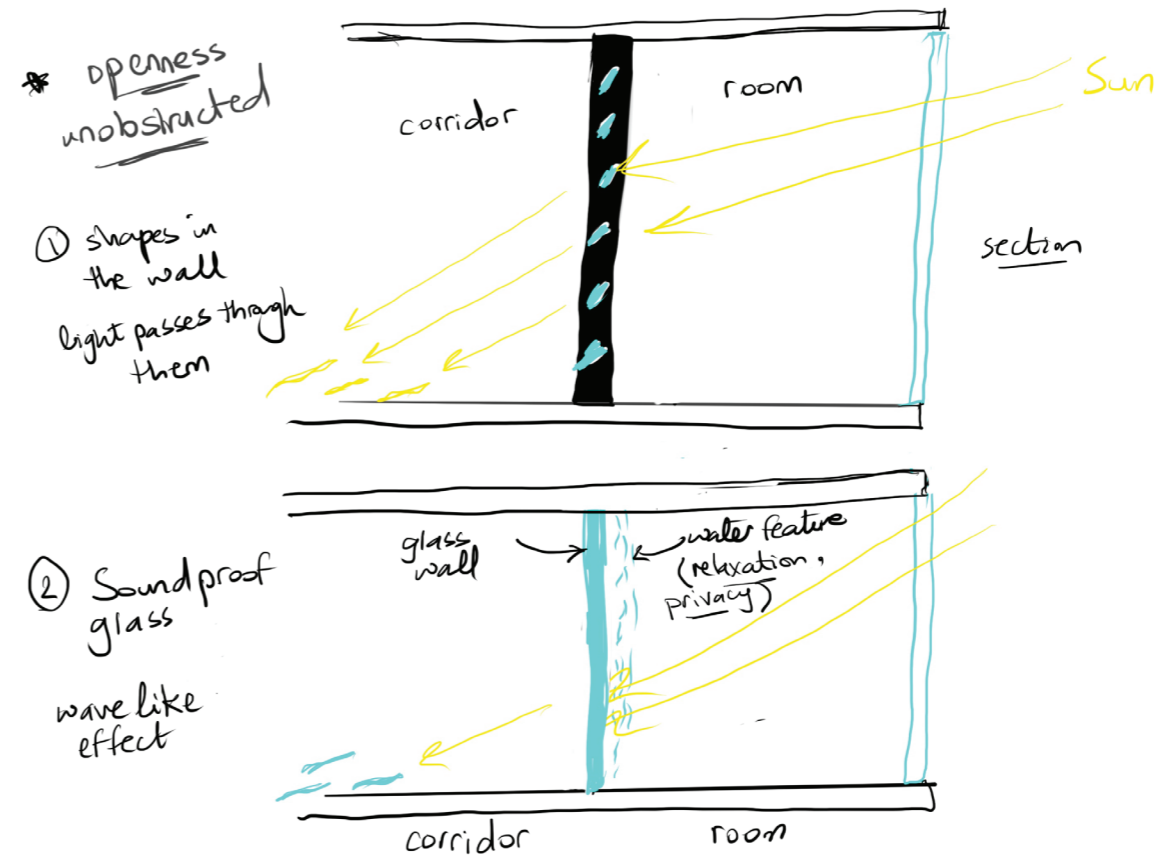
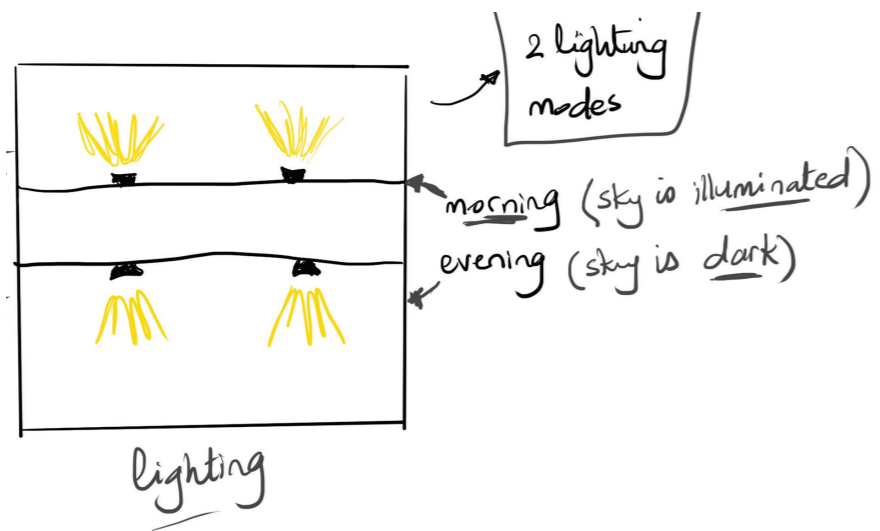
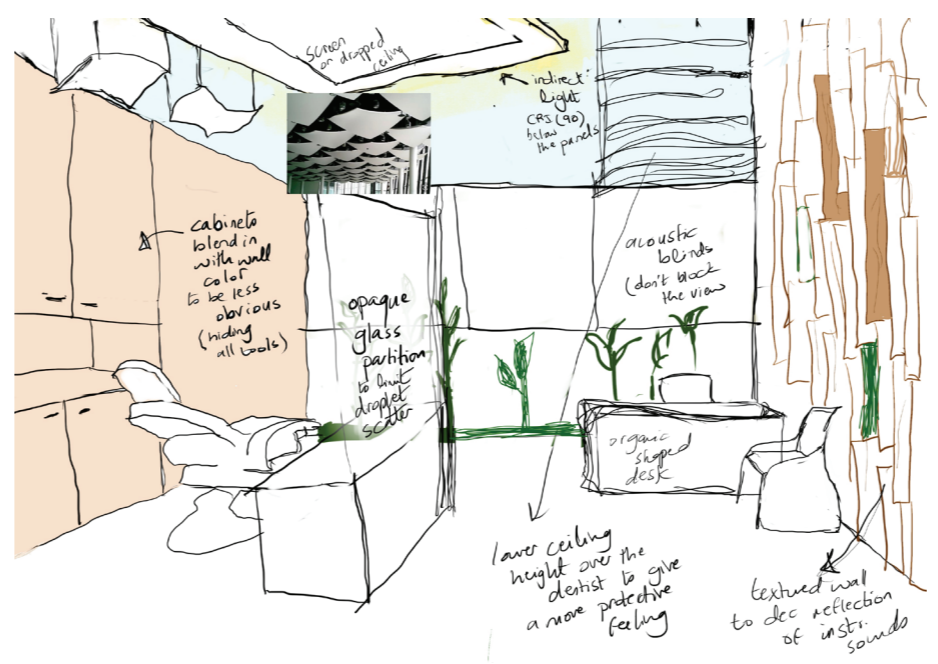
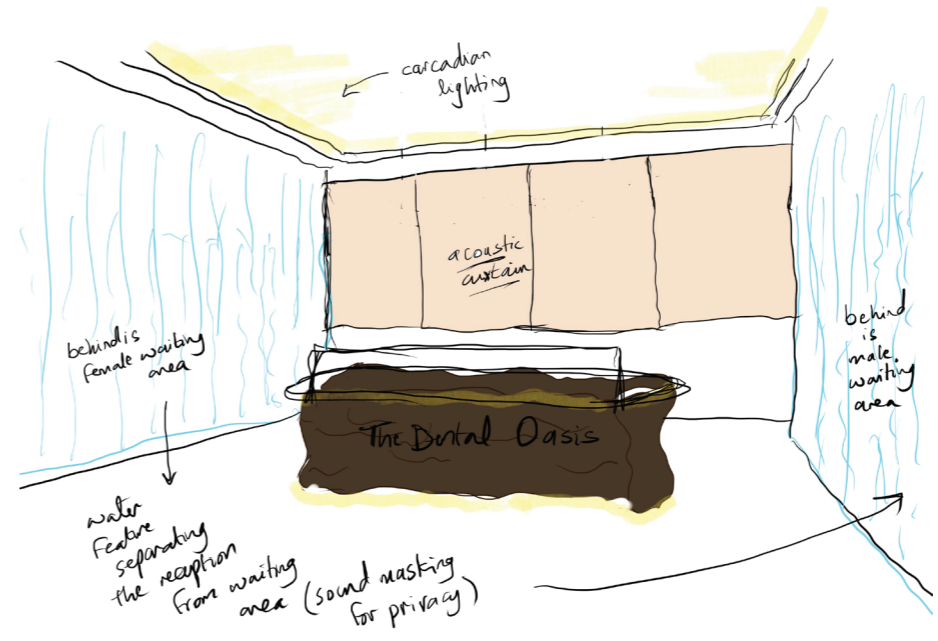
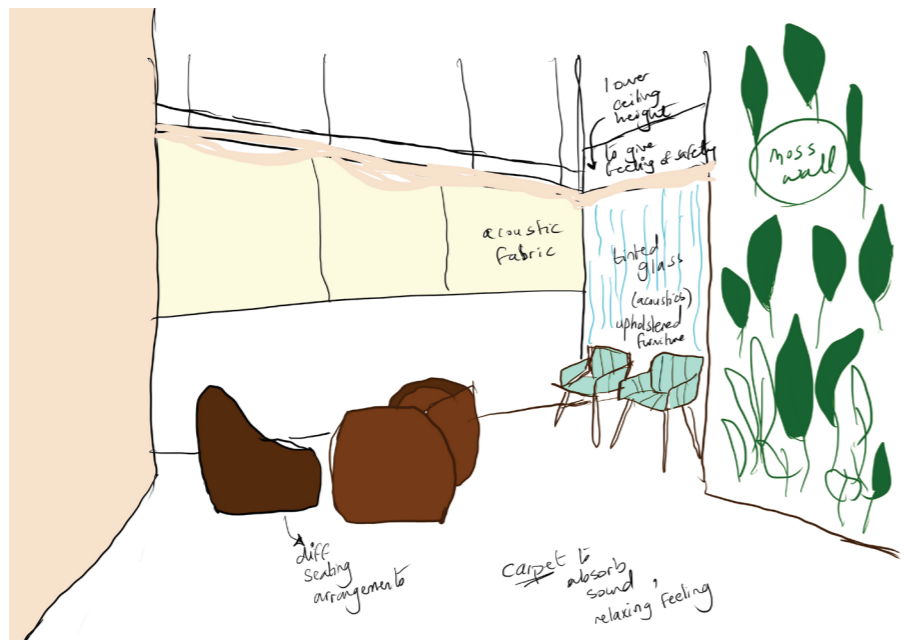


Fig. 65 image showing spatial ADA requirements for wheelchair users

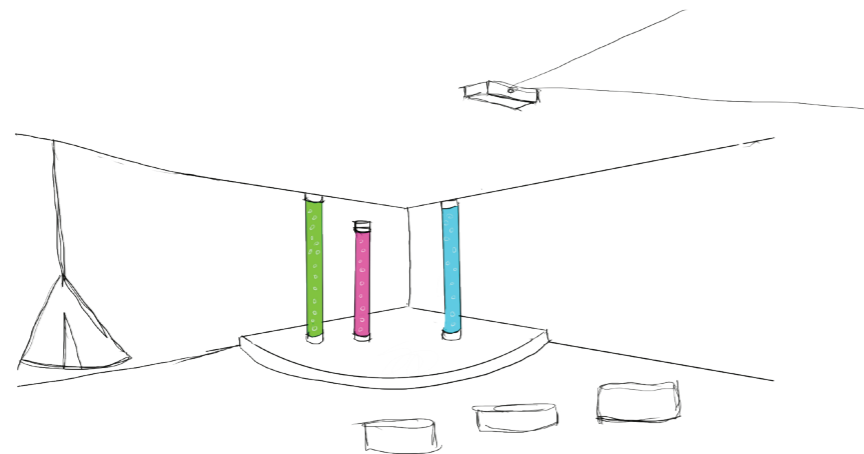
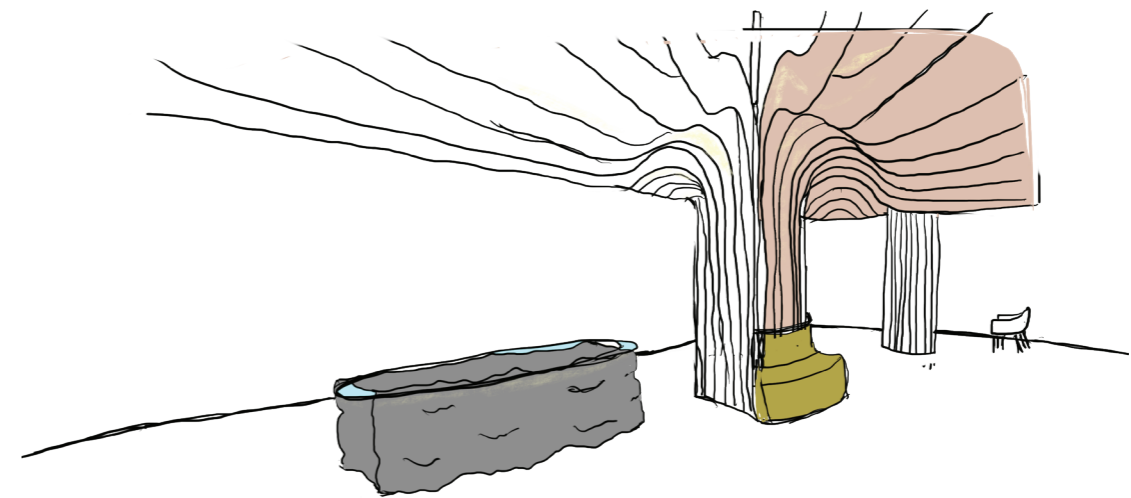
Conceptual and schematic phases



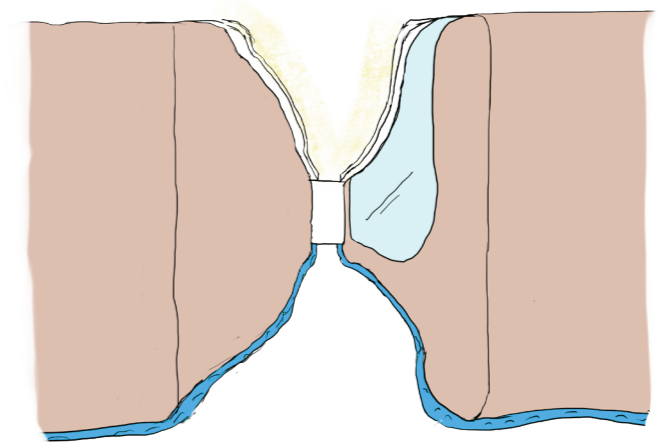




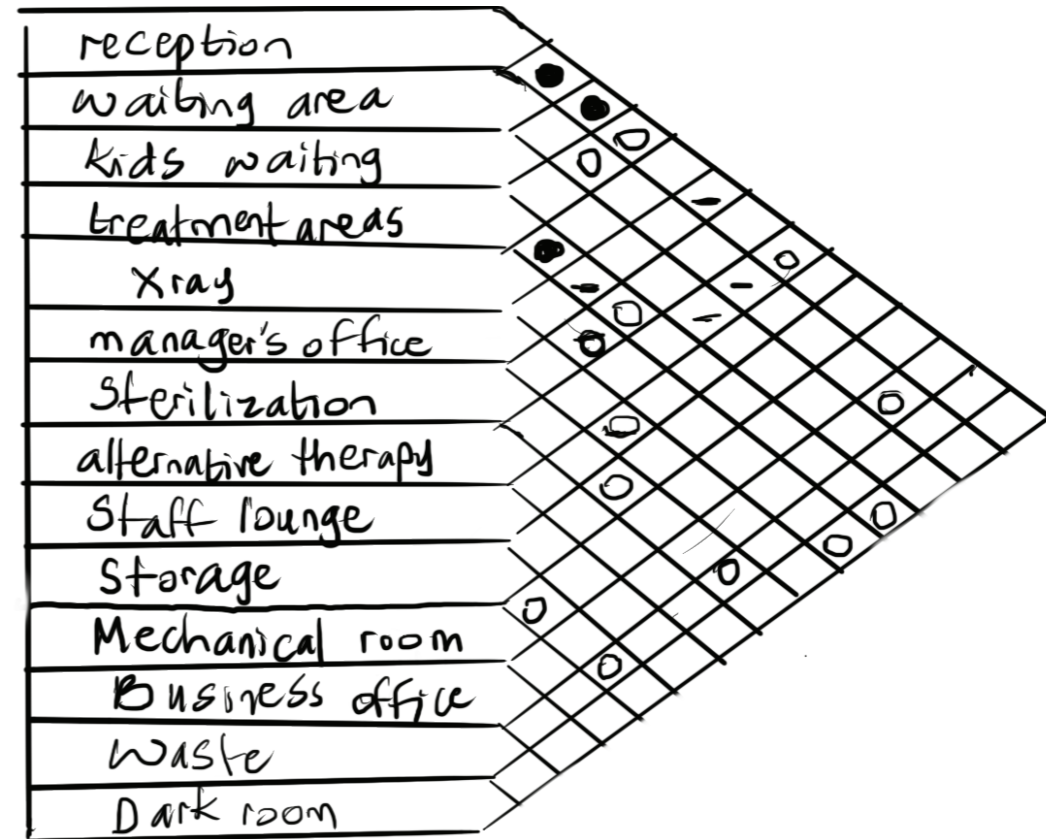
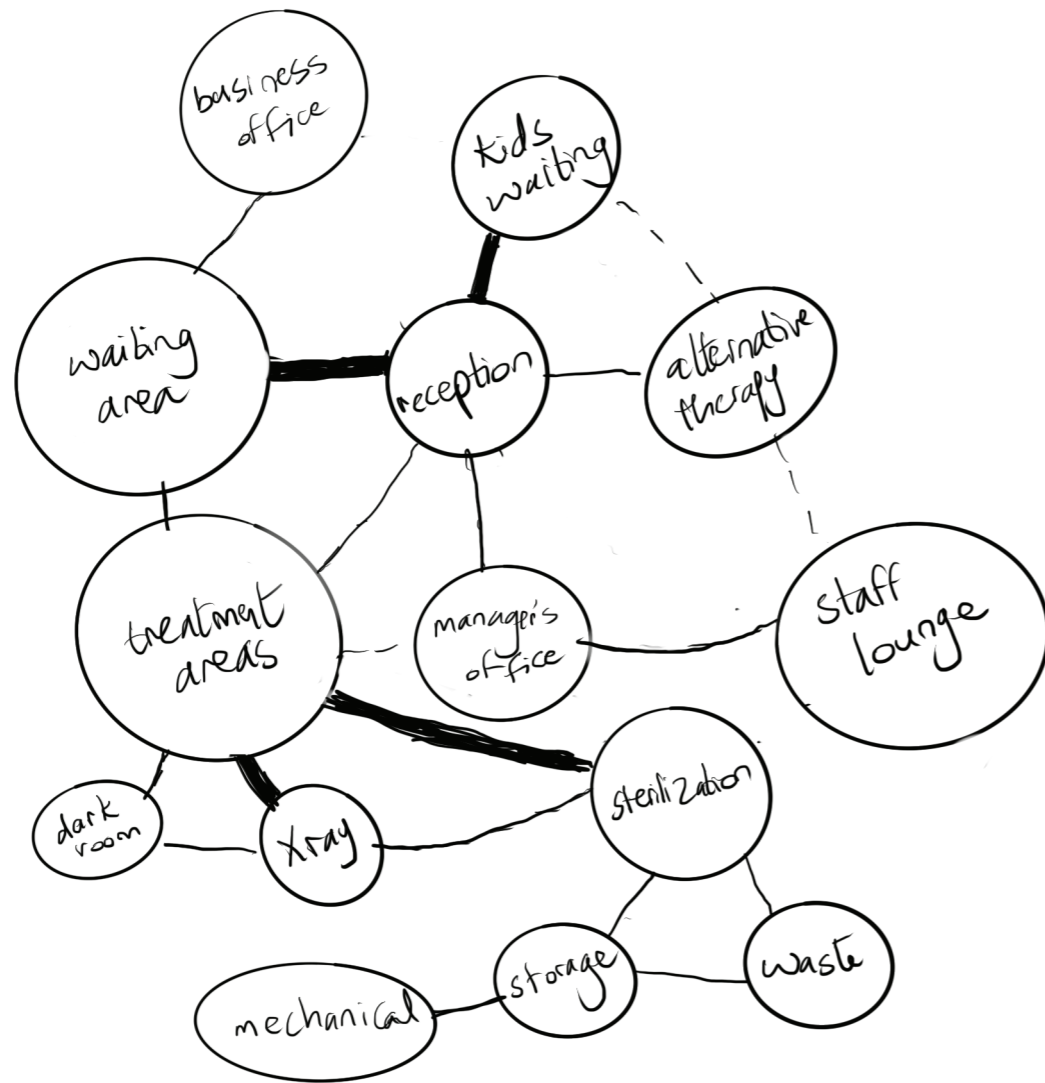
This lowered ceiling design resembles the refuge areas of being “under a tree”. Circadian lighting will be used accentuating the organic geometries during the night and day. This ceiling design also has sound absorptive functions. The waiting and reception areas are open to each other to create an unobstructed view. Speakers playing natural sounds will be used as a masking sound



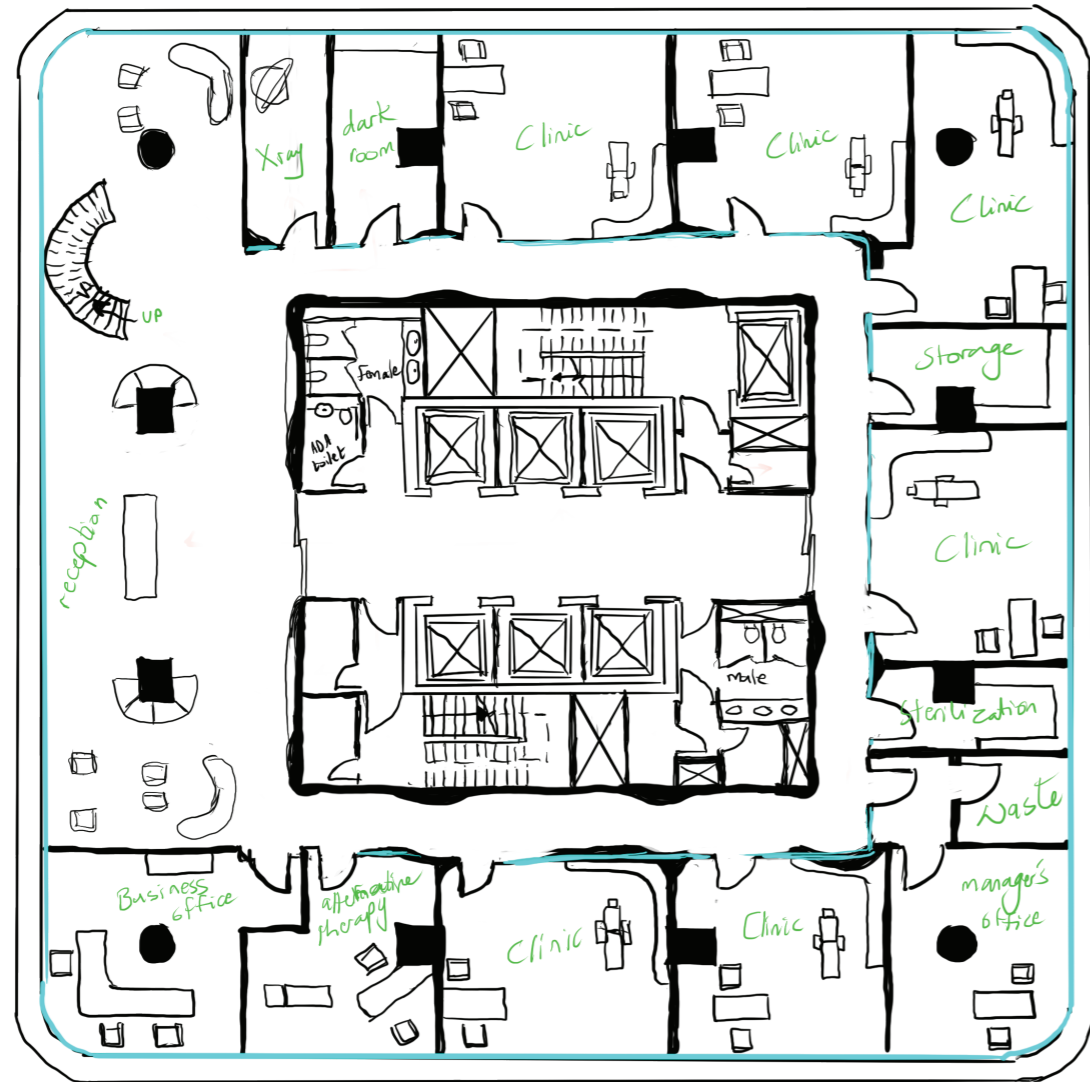
A dark multisensory room is used with different textures to stimulate the haptic sense. The sound of bubbling water relaxes the patients.



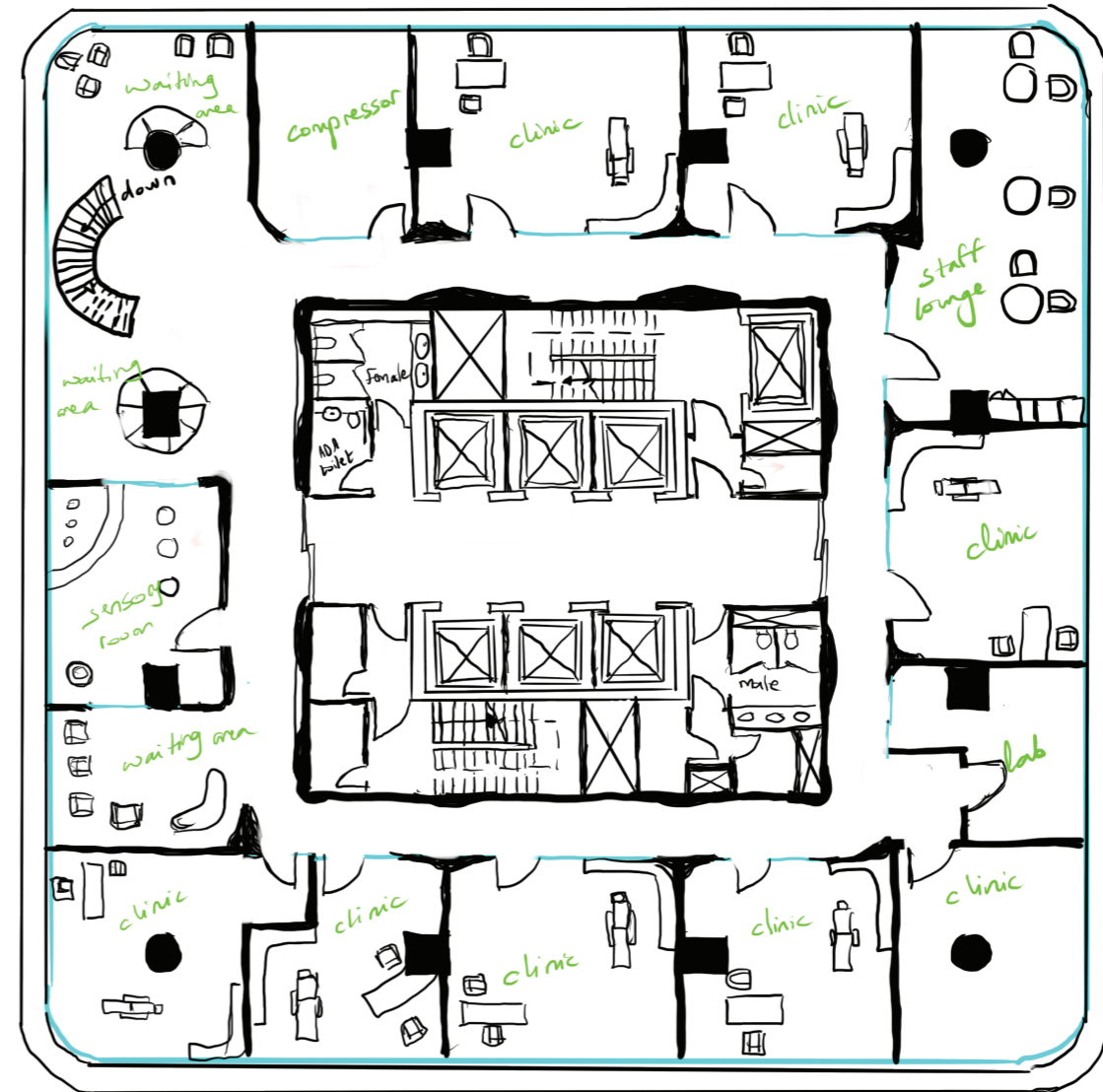
The sound of the Water feature along the corridor relaxes the patients during their journey to the treatment area. Circadian lighting resembles the feeling of being outdoors



- primary adjacency
- secondary adjacency
- distant adjacency



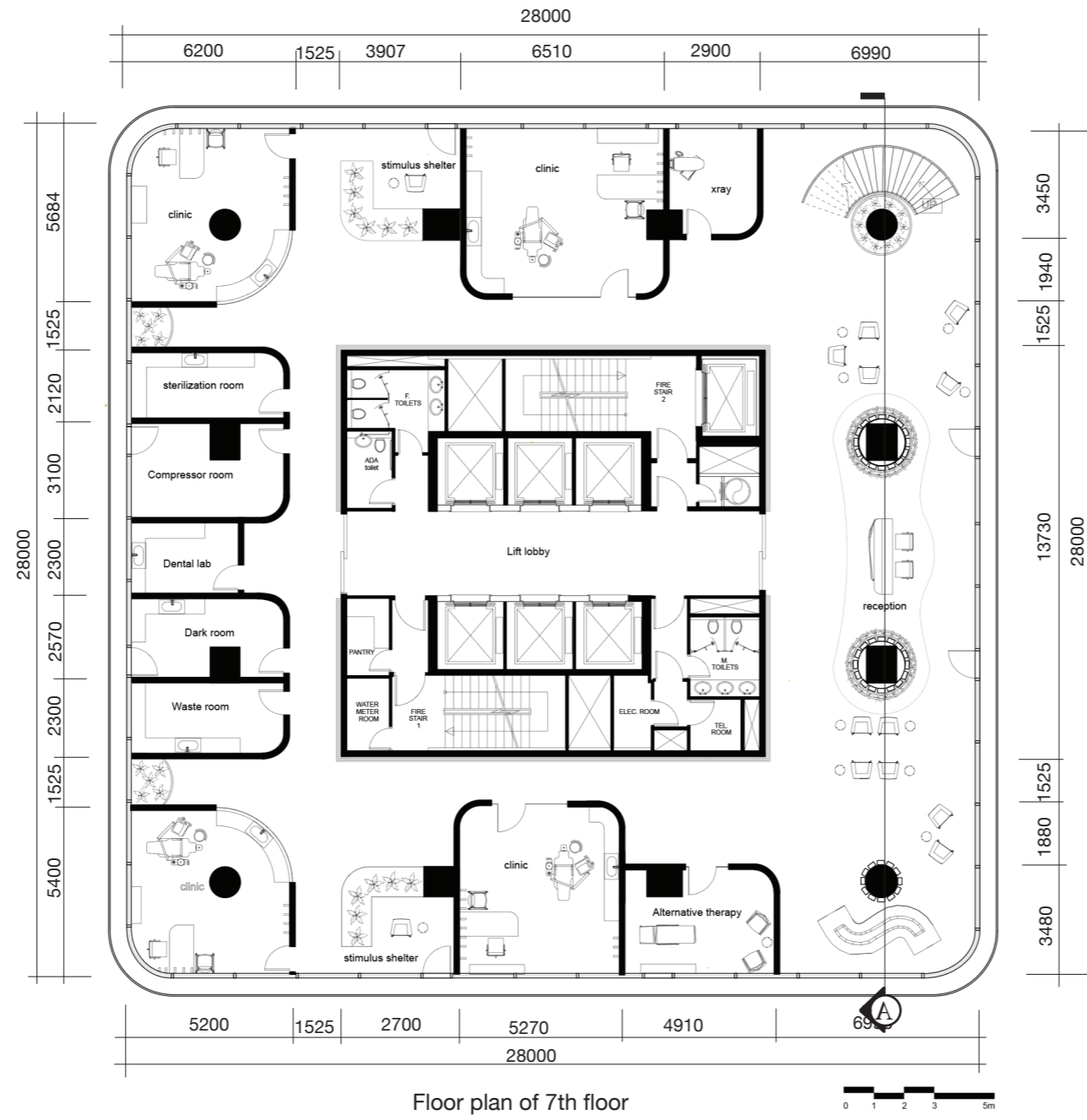
7th floor



8th floor

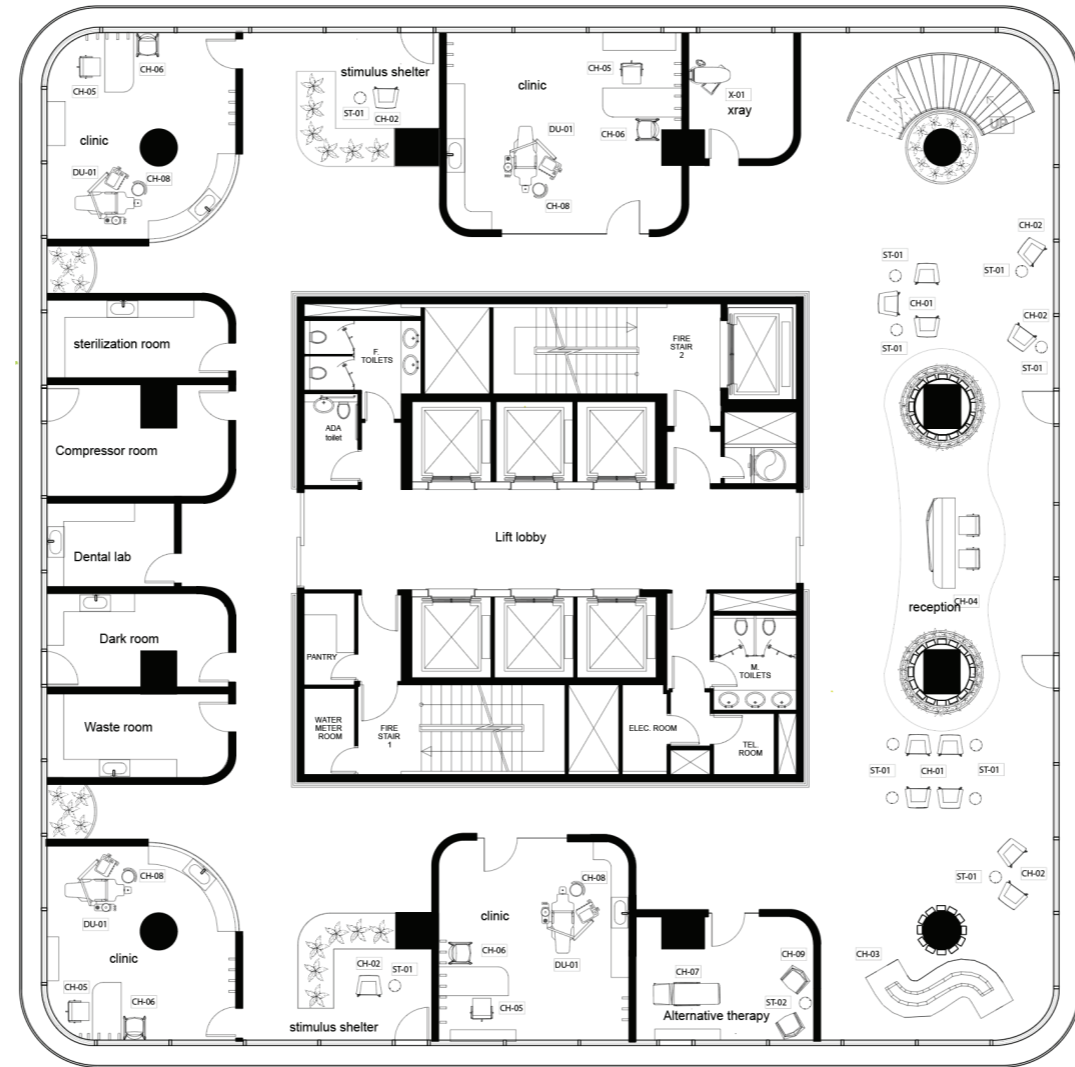
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Floor plans



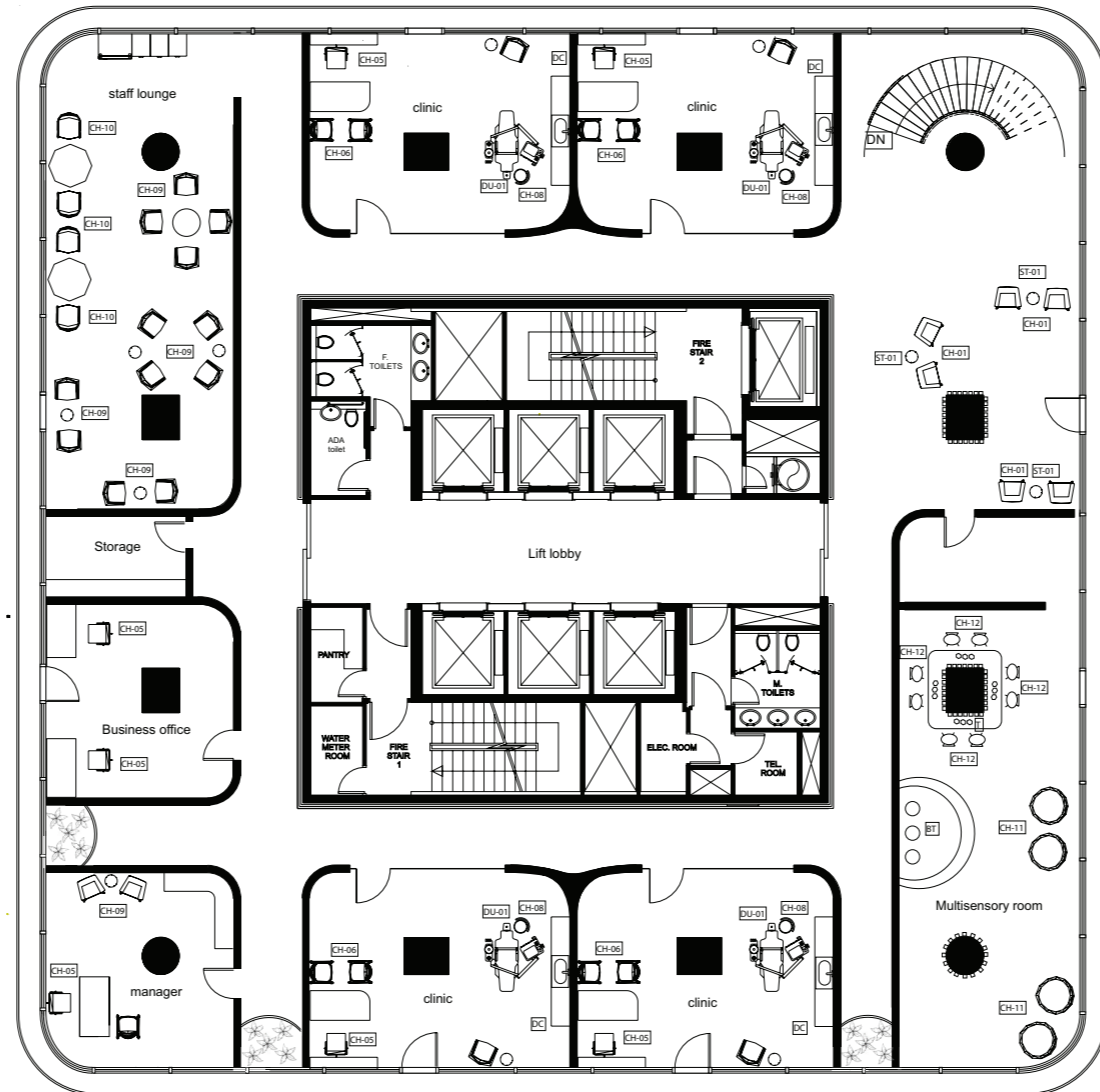
Floor plan of 7th floor

Furniture plans



Furniture plan of 7th floor























Furniture plan of 8th floor



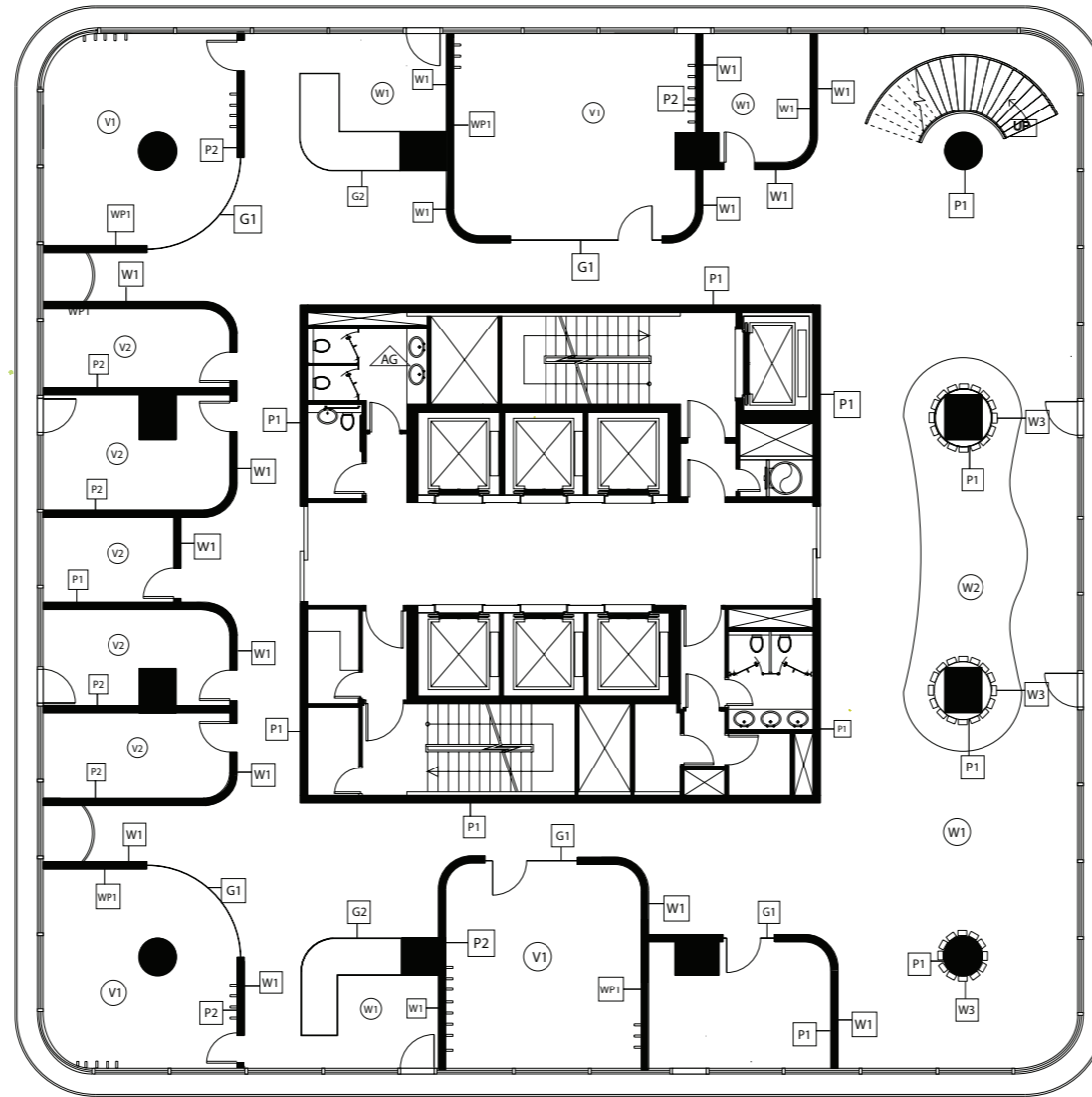
Furniture Schedule

Tag	Product	Measurements	Materials	Qty	Supplier	Image
ST-01	Denro solid wood table	13x13x16 inch	wood	12	OFS	
ST-02	Side table	15.75"D x 19.25"H	wood	4	Citizenry	
CH-01	Elide lounge seating	28x30x31.5 inch	textile	13	OFS	
CH-02	Elide lounge seating	28x30x31.5 inch	textile	6	OFS	
CH-03	Sofa	236x81x35.5 inch	Fabric and Metal	1	Appliances connection	
CH-04	Office chair	19.5"w 26.5"d 35.5-38.5"h	Metal, vinyl	2	Eurway	
CH-05	Upholestered High back Office Chair	28*27*47 inch	Vinyl, metal arms	11	BOSS office products	

Tag	Product	Measurements	Materials		Supplier	Image
CH-06	Side chair	86*50*50 cm	Vinyl, metal	12	HHM	
CH-07	Massage bed	H 57/83 x 75 x 183/211 cm	Beech wood, Vinyl	1	Nilo	
CH-08	Medical Stool High Density Foam Chrome Base Pneumatic Lift	24 in. W x 24 in. D x 26.5 in. H	Vinyl, metal	8	BOSS office products	
CH-09	Temple webster	835*800*500 mm	Faux leather	16	Temple webster	
CH-10	Dining chair	840*500*500 mm	polypropene plastic	4	Smartfit chair	
CH-11	Bean bag	150cm diameter x 50cmH	Vinyl	4	Rompa	
CH-12	Kids chair	46x54x80 cm	Steel, plastic	8	Ikea	

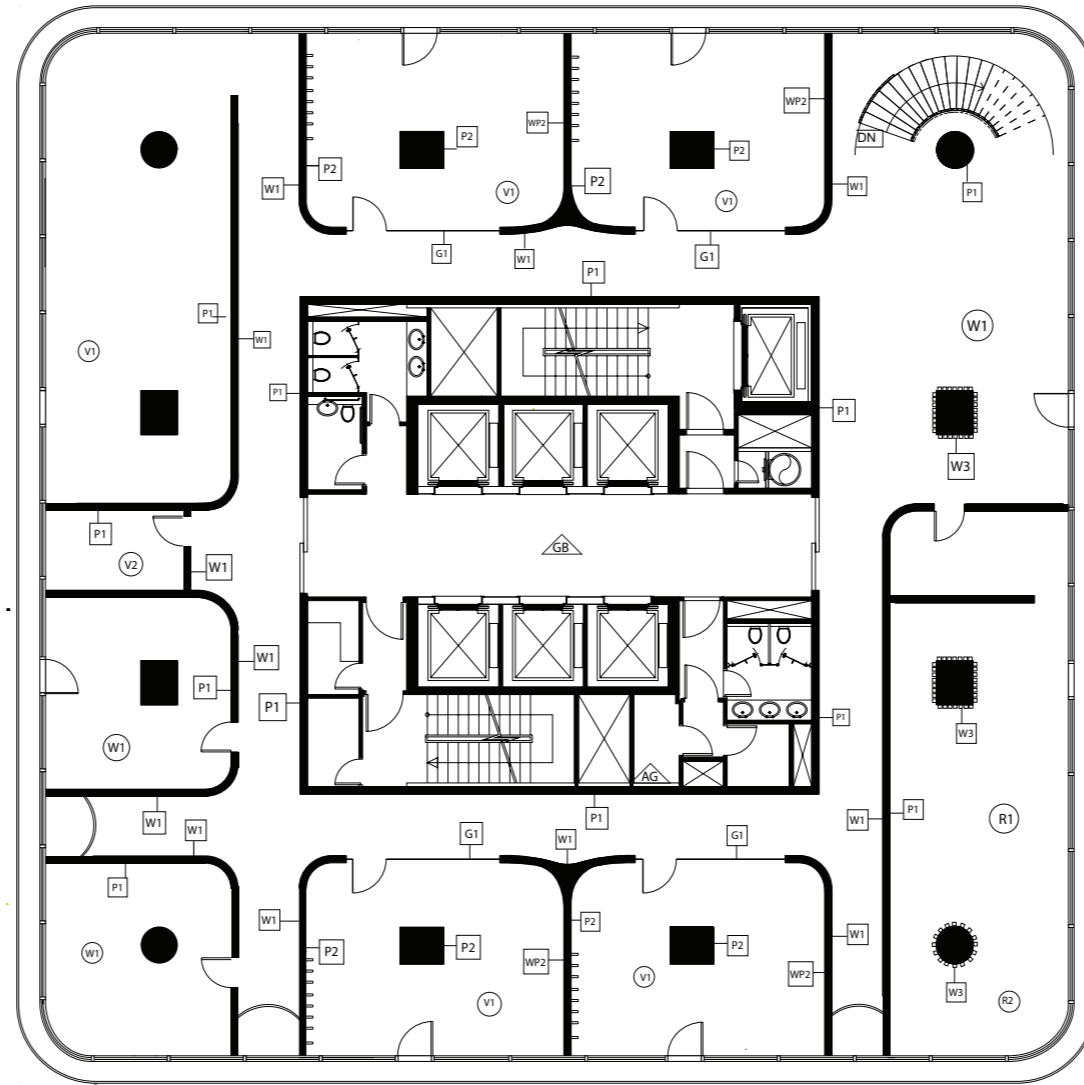
Tag	Product	Measurements	Materials	Qty	Supplier	Notes	Image
DU-01	Dental chair with massage feature	146*1060*113 Cm	Vinyl	8	Adec	Dental task light LED light 5500 K	
BT	Bubble tube	Custom		3	Rompa	—	
FC-01	Floor cushion	15mm thick	vinyl covering	2	Rompa	—	
DC	Dental cabinet	custom	corian mimicing wood	8	custom manufactured by others	—	

Finish Plans

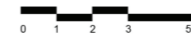


Finish plan of 7th floor





Finish plan of 8th floor





Finish Schedule

Walls



Code	Description	Color	Area	Finish	Image
W1	Walnut wood cladding	medium brown	All room outer walls	Smooth	
WP1	Botanical pattern wall paper	light green	Clinics	Smooth Antibacterial/ antimicrobial	
P1	Paint	Creamy white	All non treatment areas	Satin	
P2	Paint	Creamy white	treatment and service areas	Satin Hygiene Antibacterial paint	
W3	Walnut wood cladding	medium brown	Waiting areas	Smooth	
G1	12 mm soundproof glass	White	Clinics	Frosted	




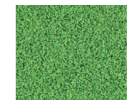
Finish Schedule

□ Walls

Code	Description	Color	Area	Finish	Image
G2	Glass	Transpatent	Stimulus shelter	Smooth	
WP2	Hygiene Wallpaper	Multicolor	Pediatric clinics	Smooth Antibacterial, antimicrobial	

○ Floors

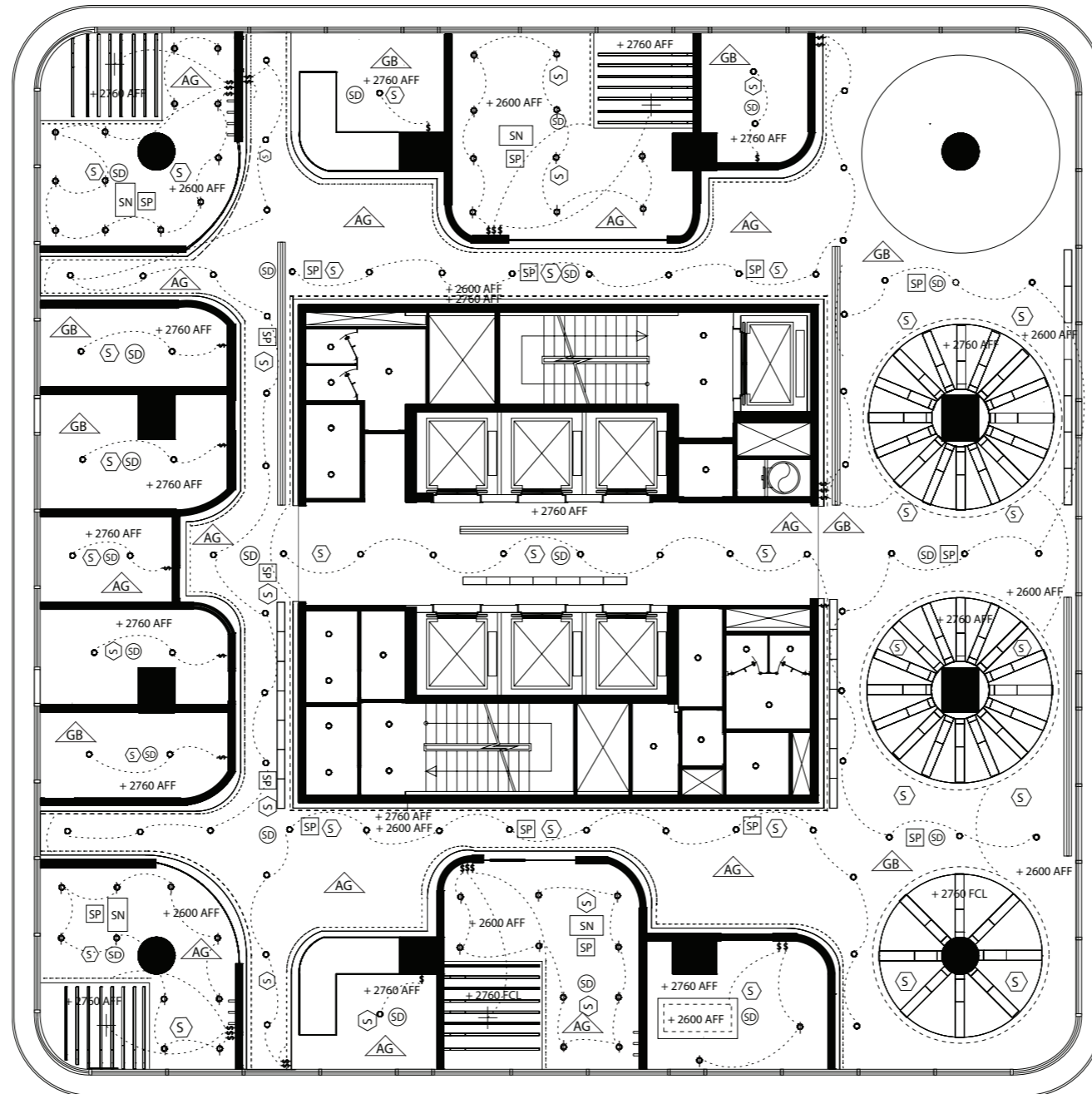
Code	Description	Color	Area	Finish	Image
W1	Oakwood flooring	Beige	Waiting area, corridors	Smooth	
W2	Birchwood flooring	Dark brown	Reception area	Smooth	

Code	Description	Color	Area	Finish	Image
V1	Vinyl flooring	light brown	Clinics	Smooth, mimicing wood	
V2	Vinyl flooring	light beige	service areas	Smooth	
R1	Rubber flooring	Beige	Multisensory room	Smooth	
R2	Artificial grass	green	Multisensory room	Textured	

△ Ceilings

Code	Description	Color	Area	Supplier
△GB	regular paint on gypsum board	white	All areas except corridors, clinics	Jotun
△AG	Acoustic paint on gypsum board ceiling	white	Corridors, clinics	SONEX AFS





RCP



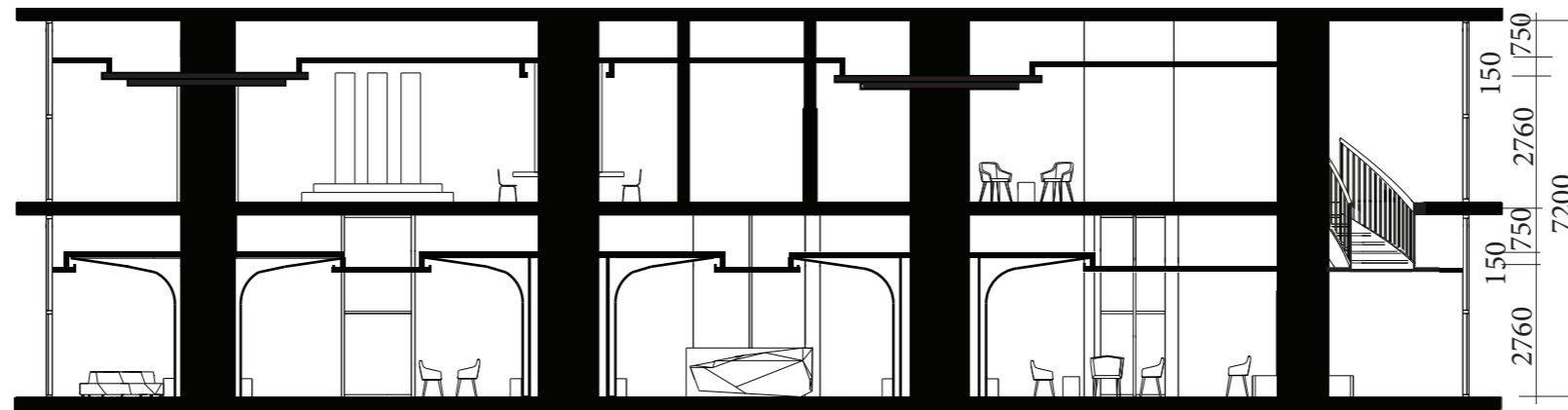
Legend

○	recessed can
⊙	recessed can
⬡	sprinkler
⊙	smoke detector
+	pendant light
— —	COV
≡≡≡	Supply
▭	Return
SN	Screen
△	regular paint on gypsum board
△	Acoustic paint on gypsum board
SP	Speaker

Lighting specifications

Symbol	Type	Qty	Area	Color temperature	Image
○	recessed can	120	Waiting areas and corridor	Warm light 3000K	
— —	COV		Corridors	3500K	
+	Pendant light	8	Dentist office area	4000K	
⊕	recessed can	80	clinics	4500K	

Section A



Rendered 7th floor



Rendered 8th floor



Rendered section



*NTS







Endnotes

- 1, 2 - Beaton, Laura, Ruth Freeman, and Gerry Humphris. "Why Are People Afraid of the Dentist? Observations and Explanations." *Medical Principles and Practice* 23, no. 4 (2013): 295–301. <https://doi.org/10.1159/000357223>.
- 3 - Anthonappa, Robert P, Paul F Ashley, Debbie L Bonetti, Guido Lombardo, and Philip Riley. "Non-Pharmacological Interventions for Managing Dental Anxiety in Children." *Cochrane Database of Systematic Reviews*, 2017. <https://doi.org/10.1002/14651858.cd012676>.
- 4 - Pati, Debajyoti, and Upali Nanda. "Influence of Positive Distractions on Children in Two Clinic Waiting Areas." *HERD: Health Environments Research & Design Journal* 4, no. 3 (2011): 124–40. <https://doi.org/10.1177/193758671100400310>.
- 5, 7, 8, 12, 16, 17, 20, 27, 29 - Appukuttan, Devapriya. "Strategies to Manage Patients with Dental Anxiety and Dental Phobia: Literature Review." *Clinical, Cosmetic and Investigational Dentistry*, 2016, 35. <https://doi.org/10.2147/ccide.s63626>.
- 6, 9, 10, 13, 21 - Armfield, JM, and LJ Heaton. "Management of Fear and Anxiety in the Dental Clinic: A Review." *Australian Dental Journal*, vol. 58, no. 4, 2013, pp. 390–407., <https://doi.org/10.1111/adj.12118>.
- 11 - Townsend, Janice A., and Martha H. Wells. "Behavior Guidance of the Pediatric Dental Patient." *Pediatric Dentistry*, 2019. <https://doi.org/10.1016/b978-0-323-60826-8.00024-9>.
- 14 - Mahiepala, N. A., V. L. Phan, K. D. Kieu, J. P. L. Koppen, B. H. Hussain, and Boyen Huang. "Influencing factors of paediatric dental anxiety levels in an undergraduate dental clinic." *Eur J Paediatr Dent* 16, no. 2 (2015): 159-162. PMID: 26147825.
- 15 - Nowak, Marta Justyna, Heather Buchanan, and Koula Asimakopoulou. "'You Have to Treat the Person, Not the Mouth Only': UK Dentists' Perceptions of Communication in Patient Consultations." *Psychology, Health & Medicine* 23, no. 6 (2018): 752–61. <https://doi.org/10.1080/13548506.2018.1457167>.
- 18 - Cianetti, Stefano, Luigi Paglia, Roberto Gatto, Alessandro Montedori, and Eleonora Lupatelli. "Evidence of Pharmacological and Non-Pharmacological Interventions for the Management of Dental Fear in Paediatric Dentistry: A Systematic Review Protocol." *BMJ Open* 7, no. 8 (2017). <https://doi.org/10.1136/bmjopen-2017-016043>.
- 19, 25, 30 - Rath, Sujata, and Madhuri Khandelwal. "Effectiveness of Distraction Techniques in Managing Pediatric Dental Patients." *International Journal of Clinical Pediatric Dentistry* 12, no. 1 (2019): 18–24. <https://doi.org/10.5005/jp-journals-10005-1582>.
- 22, 42 - Jiang, Shan. "Positive Distractions and Play in the Public Spaces of Pediatric Healthcare Environments: A Literature Review." *HERD: Health Environments Research & Design Journal* 13, no. 3 (2020): 171–97. <https://doi.org/10.1177/1937586720901707>.
- 23 - Fux-Noy, Avia, Maayan Zohar, Karin Herzog, Aviv Shmueli, Elinor Halperson, Moti Moskovitz, and Diana Ram. "The Effect of the Waiting Room's Environment on Level of Anxiety Experienced by Children Prior to Dental Treatment: A Case Control Study." *BMC Oral Health* 19, no. 1 (2019). <https://doi.org/10.1186/s12903-019-0995-y>.
- 24 - Panda, A., I. Garg, and M. Shah. "Children's Preferences Concerning Ambiance of Dental Waiting Rooms." *European Archives of Paediatric Dentistry* 16, no. 1 (2014): 27–33. <https://doi.org/10.1007/s40368-014-0142-z>.
- 26 - Tanja-Dijkstra, Karin, Sabine Pahl, Mathew P. White, Melissa Auvray, Robert J. Stone, Jackie Andrade, Jon May, Ian Mills, and David R. Moles. "The Soothing Sea: A Virtual Coastal Walk

- 26- Tanja-Dijkstra, Karin, Sabine Pahl, Mathew P. White, Melissa Auvray, Robert J. Stone, Jackie Andrade, Jon May, Ian Mills, and David R. Moles. "The Soothing Sea: A Virtual Coastal Walk Can Reduce Experienced and Recollected Pain." *Environment and Behavior* 50, no. 6 (2017): 599–625. <https://doi.org/10.1177/0013916517710077>.
- 28, 34 - Rosiak, Joanna, and Jolanta Szymańska. "Non-Pharmacological Methods of Fighting Dental Anxiety." *Journal of Pre-Clinical and Clinical Research* 12, no. 4 (2018): 145–48. <https://doi.org/10.26444/jpccr/99771>.
- 31- MOHAMMAD-ZADEH, L. F., L. MOSES, and S. M. GWALTNEY-BRANT. "Serotonin: A Review." *Journal of Veterinary Pharmacology and Therapeutics* 31, no. 3 (2008): 187–99. <https://doi.org/10.1111/j.1365-2885.2008.00944.x>.
- 32, 41, 50, 52 - Totaforti, Simona. "Applying the Benefits of Biophilic Theory to Hospital Design." *City, Territory and Architecture* 5, no. 1 (2018). <https://doi.org/10.1186/s40410-018-0077-5>.
- 33- "The Impact of Windows, Daylight and views of nature on health and wellbeing in health care facilities - Eprints.qut.edu.au." Accessed December 4, 2021. <https://eprints.qut.edu.au/109189/>.
- 35, 39 - "Color In Healthcare Environments - A Research Report." The Coalition for Health Environments Research (CHER), July 2004.
- 36, 40, 43- Malkin, Jain. A visual reference for evidence-based design. Center for Health Design, 2008.
- 37- Bridget Cogley. "Natasha Thorpe Uses Timber to Soften Mood at Quebec Dental Office." *Dezeen*, July 28, 2020. <https://www.dezeen.com/2018/03/07/natasha-thorpe-design-timber-soften-mood-go-orthodontistes-dental-clinic-quebec/>.
- 38- Design, Natasha Thorpe. "Go Orthodontistes Clinic by Natasha Thorpe Design: Doctors' Surgeries." *Architonic*. Architonic, April 13, 2018. <https://www.architonic.com/en/project/natasha-thorpe-design-go-orthodontistes-clinic/5105875>.
- 44- "Soto Dental Clinic by Vitale." *Archiscene*, October 15, 2021. <https://www.archiscene.net/medical-architecture/soto-dental-clinic-vitale/>.
- 45- "About Qatar -Interesting Information." <https://hukoomi.gov.qa>. Accessed November 22, 2021. <https://hukoomi.gov.qa/en/about-qatar/about-qatar>.
- 46 - "Data.org." *Climate*. Accessed November 22, 2021. <https://en.climate-data.org/asia/qatar/umm-salal/lusail-716427/>.
- 47 - "Smart City". Lusail City. Retrieved 14 January 2019.
- 48- "Our Projects." *Qatari Diar - Lusail City*. Accessed December 5, 2021. <https://www.qataridiar.com/English/OurProjects/Pages/Lusail-City.aspx>.
- 49 - "Marina Twin Towers." Accessed November 22, 2021. <https://www.marinatwintowers.com/wp-content/uploads/2021/04/Marina-Twin-Towers-Brochure.pdf>.
- 50 - Ibrahim, Menatalla. "Qatar Ministries Come Together to Solve Doha's 'Traffic Nightmare'." *Doha News | Qatar*, October 10, 2021. <https://www.dohanews.co/qatar-ministries-come-together-to-solve-dohas-traffic-nightmare/>.

- 53 Appukuttan, Devapriya. "Strategies to Manage Patients with Dental Anxiety and Dental Phobia: Literature Review." *Clinical, Cosmetic and Investigational Dentistry*, 2016, 35. <https://doi.org/10.2147/ccide.s63626>.
- 54 MacDonald, Ann. "Dental Fear? Our Readers Suggest Coping Techniques." *Harvard Health*, August 25, 2010. <https://www.health.harvard.edu/blog/dental-fear-our-readers-suggest-coping-techniques-20100825327>.
- 55 Pati, Debajyoti, and Upali Nanda. "Influence of Positive Distractions on Children in Two Clinic Waiting Areas." *HERD: Health Environments Research & Design Journal* 4, no. 3 (2011): 124–40. <https://doi.org/10.1177/193758671100400310>.
- 56,59 Totaforti, Simona. "Applying the Benefits of Biophilic Theory to Hospital Design." *City, Territory and Architecture* 5, no. 1 (2018). <https://doi.org/10.1186/s40410-018-0077-5>.
- 57 Huelat, Barbara J. "The Wisdom of Biophilia-Nature in Healing Environments." *Journal of Green Building*. Allen Press, August 1, 2008. <https://doi.org/10.3992/jgb.3.3.23>.
- 58 Zhong, Weijie, Torsten Schröder, and Juliette Bekkering. "Biophilic Design in Architecture and Its Contributions to Health, Well-Being, and Sustainability: A Critical Review." *Frontiers of Architectural Research*. Elsevier, August 31, 2021. <https://www.sciencedirect.com/science/article/pii/S2095263521000479>.
- 60 Browning, William, et al. "14 Patterns of Biophilic Design. Improving Health and Wellbeing in the Built Environment." Terrapin Bright Green, LLC. <https://www.terrapinbrightgreen.com/wp-content/uploads/2014/09/14-Patterns-of-Biophilic-Design-Terrapin-2014p.pdf>.
- 61 Armfield, JM, and LJ Heaton. "Management of Fear and Anxiety in the Dental Clinic: A Review." *Australian Dental Journal*, vol. 58, no. 4, 2013, pp. 390–407., <https://doi.org/10.1111/adj.12118>
- 62 Appukuttan, Devapriya. "Strategies to Manage Patients with Dental Anxiety and Dental Phobia: Literature Review." *Clinical, Cosmetic and Investigational Dentistry*, 2016, 35. <https://doi.org/10.2147/ccide.s63626>.
- 63 Armfield, JM, and LJ Heaton. "Management of Fear and Anxiety in the Dental Clinic: A Review." *Australian Dental Journal*, vol. 58, no. 4, 2013, pp. 390–407., <https://doi.org/10.1111/adj.12118>.
- 64 Townsend, Janice A., and Martha H. Wells. "Behavior Guidance of the Pediatric Dental Patient." *Pediatric Dentistry*, 2019. <https://doi.org/10.1016/b978-0-323-60826-8.00024-9>.
- 65 Dutta, Arindam, Kundabala Mala, and Shashi Rashmi Acharya. "Sound Levels in Conservative Dentistry and Endodontics Clinic." *Journal of conservative dentistry : JCD*. Medknow Publications & Media Pvt Ltd, March 2013. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3659855/>.
- 66,70 "Noise Levels in Dental Offices and Laboratories in Hamedan, Iran" Accessed January 31, 2022. https://www.researchgate.net/publication/228657546_Noise_Levels_in_Dental_Offices_and_Laboratories_in_Hamedan_Iran
- 67,71,73 "Acoustics in Healthcare Environments - CISCA." Accessed January 31, 2022. http://cisca.org/files/public/Acoustics%20in%20Healthcare%20Environments_CISCA.pdf. <http://www.cisca.org/files/public/Acoustics%20in%20Healthcare%20Environments%20Synopsis.pdf>

- 68, Yousuf, Asif, Shravani Ganta, Anup Nagaraj, Sonia Pareek, Mansi Atri, Kushpal Singh, and Mohsin Sidiq. "Acoustic Noise Levels of Dental Equipments and Its Association with Fear and Annoyance Levels among Patients Attending Different Dental Clinic Setups in Jaipur, India." *Journal of clinical and diagnostic research : JCDR*. JCDR Research and Publications (P) Limited, April 2014. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4064894/>.
- 69 "An Experimental Study on the Noise Reductive ... - Irbnet.de." Accessed January 31, 2022. <https://www.irbnet.de/daten/iconda/CIB3725.pdf>.
- 72 Yousuf, Asif, Shravani Ganta, Anup Nagaraj, Sonia Pareek, Mansi Atri, Kushpal Singh, and Mohsin Sidiq. "Acoustic Noise Levels of Dental Equipments and Its Association with Fear and Annoyance Levels among Patients Attending Different Dental Clinic Setups in Jaipur, India." *Journal of clinical and diagnostic research : JCDR*. JCDR Research and Publications (P) Limited, April 2014. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4064894/>.
- 74 "Noise Pollution in Dentistry." *Bite Magazine*, May 19, 2019. <https://bitemagazine.com.au/noise-pollution-in-dentistry/>.
- 75 "Sound Proof Glass Partitions." *Glass Partitioning*. Accessed January 31, 2022. <https://axisglass.co.uk/acoustics-acoustic-glass>.
- 76 Darron Chin-Quee. "Noise and Acoustics for Healthcare Design." *RWDI-consulting engineers and scientists*, n.d. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.527.3053&rep=rep1&type=pdf>.
- 77 Appukuttan, Deva Priya. "Strategies to Manage Patients with Dental Anxiety and Dental Phobia: Literature Review." *Clinical, cosmetic and investigational dentistry*. Dove Medical Press, March 10, 2016. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4790493/>.
- 79 Ma, Kuen Wai, Hai Ming Wong, and Cheuk Ming Mak. "Dental Environmental Noise Evaluation and Health Risk Model Construction to Dental Professionals." *International journal of environmental research and public health*. MDPI, September 19, 2017. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5615621/>.
- 80 EPA. Environmental Protection Agency. Accessed February 1, 2022. <https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality>.
- 81 Joshi, Sumedha M. "The Sick Building Syndrome." *Indian journal of occupational and environmental medicine*. Medknow Publications, August 2008. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751/>.
- 82 "Health Care Facilities - ASHRAE." Accessed February 1, 2022. https://www.ashrae.org/file%20library/technical%20resources/covid-19/i-p_a19_ch09_health_care_facilities.pdf.
- 83 EPA. Environmental Protection Agency. Accessed February 1, 2022. <https://www.epa.gov/iaq-schools/moisture-control-part-indoor-air-quality-design-tools-schools>.
- 84 U.S. Department of Veterans Affairs; Office of Acquisition, Logistics and Construction; Office of Construction and Facilities Management. "Va.gov: Veterans Affairs." *DESIGN GUIDES (PG-18-12)*, March 6, 2009. <https://www.cfm.va.gov/til/dGuide.asp>.
- 85 Ren YF;Huang Q;Marzouk T;Richard R;Pembroke K;Martone P;Venner T;Malmstrom H;Eliav E; "Effects of Mechanical Ventilation and Portable Air Cleaner on Aerosol Removal from Dental Treatment Rooms." *Journal of dentistry*. U.S. National Library of Medicine. Accessed February 1, 2022. <https://pubmed.ncbi.nlm.nih.gov/33388387/>.

86 Cocârță, Diana Mariana, Mariana Prodana, Ioana Demetrescu, Patricia Elena Maria Lungu, and Andreea Cristiana Didilescu. "Indoor Air Pollution with Fine Particles and Implications for Workers' Health in Dental Offices: A Brief Review." MDPI. Multidisciplinary Digital Publishing Institute, January 10, 2021. <https://www.mdpi.com/2071-1050/13/2/599>.

87 "Ventilation/Temperature/Relative Humidity - Dental Health Settings - Instrument Processing." The Joint Commission, November 15, 2021. <https://www.jointcommission.org/standards/standard-faqs/ambulatory/environment-of-care-ec/000001270/>.

88 "Use of Living Pot-Plants to Cleanse Indoor Air – Research Review" Accessed February 1, 2022. https://www.researchgate.net/profile/Fraser-Torpy/publication/228639007_Use_of_living_pot-plants_to_cleanse_indoor_air-research_review/links/0c9605163ac6b637de000000/Use-of-living-pot-plants-to-cleanse-indoor-air-research-review.pdf.

89 Helmis, C.G., J. Tzoutzas, H.A. Flocas, C.H. Halios, O.I. Stathopoulou, V.D. Assimakopoulos, V. Panis, M. Apostolatu, G. Sgouros, and E. Adam. "Indoor Air Quality in a Dentistry Clinic." *Science of The Total Environment*. Elsevier, April 16, 2007. <https://www.sciencedirect.com/science/article/pii/S0048969707001659>.

90,112,114,124 Malkin, Jain. *Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment, and Clinical Procedures*, 3rd Edition. John Wiley & sons, INC., n.d.

91,93,95 Gupta, Anshul, Manohar Bhat, Tahir Mohammed, Nikita Bansal, and Gaurav Gupta. "Ergonomics in Dentistry." *International journal of clinical pediatric dentistry*. Jaypee Brothers Medical Publishers, January 2014. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4144062/>.

92,94,98,101 Malkin, Jain. *Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment, and Clinical Procedures*, 3rd Edition. John Wiley & sons, INC., n.d.

96 Jimson, Sudha, L. Malathi, G. Nandhini Devi, and S. Leena Sankari. "Aromatherapy in Dentistry – a Review." *Biomedical and Pharmacology Journal*, August 21, 2016. <https://biomedpharmajournal.org/vol9no2/aromatherapy-in-dentistry-a-review/>.

97 Wilms, Lisa, and Daniel Oberfeld. "Color and Emotion: Effects of Hue, Saturation, and Brightness - Psychological Research." SpringerLink. Springer Berlin Heidelberg, June 13, 2017. <https://link.springer.com/article/10.1007/s00426-017-0880-8>.

99,103 Openshaw, Scott, and Allsteel Erin Taylor. "Ergonomics and Design. A Reference Guide." *Environmental Health and Safety*. Allsteel, 2006. <https://ehs.oregonstate.edu/>.

100 Shang, Jian, et al. "Informing Healthcare Waiting Area Design Using Transparency Attributes: A Comparative Preference Study." *HERD Health Environments Research & Design Journal*, November 2016. DOI:10.1177/1937586716675581

102,104 Shah, Aasim, et al. "Ergonomics in Dental Practice" January 2014. https://www.researchgate.net/profile/Manu-Batra/publication/259975882_ERGONOMICS_IN_DENTAL_PRACTICE/links/0f31752ed2d0285948000000/ERGONOMICS-IN-DENTAL-PRACTICE.

105 Kalantari, Saleh, et al. "Evaluating the Impacts of Color, Graphics, and Architectural Features on Wayfinding in Healthcare Settings Using EEG Data and Virtual Response Testing." *Journal of Environmental Psychology*. Academic Press, December 10, 2021. <https://www.sciencedirect.com/science/article/pii/S0272494421001973>.

106 (OCR), Office for Civil Rights. "Your Rights under HIPAA." HHS.gov, January 19, 2022. <https://www.hhs.gov/hipaa/for-individuals/guidance-materials-for-consumers/index.html>

- 107, 111 Souza, Eduardo. "How Lighting Affects Mood." ArchDaily. ArchDaily, August 12, 2019. <https://www.archdaily.com/922506/how-lighting-affects-mood>.
- 108 Dalke, Hilary, Jenny Little, Elga Niemann, Nilgun Camgoz, Guillaume Steadman, Sarah Hill, and Laura Stott. "Colour and Lighting in Hospital Design." *Optics & Laser Technology* 38, no. 4-6 (2006): 343–65. <https://doi.org/10.1016/j.optlastec.2005.06.040>.
- 109 www.rtor.org, Guest Author for. "Natural Light and Mental Health." *Resources To Recover*, September 25, 2018. <https://www.rtor.org/2018/07/26/how-light-improves-mental-health/>.
- 110 Browning, William, et al. "14 Patterns of Biophilic Design. Improving Health and Wellbeing in the Built Environment." Terrapin Bright Green, LLC. <https://www.terrapinbrightgreen.com/wp-content/uploads/2014/09/14-Patterns-of-Biophilic-Design-Terrapin-2014p.pdf>.
- 113 Jafarzadeh, Hamid, Mohammadreza Nakhaei, Jalil Ghanbarzadeh, Shirin Keyvanloo, and Samin Alavi. "Shade Matching Performance of Dental Students with Three Various Lighting Conditions." *The Journal of Contemporary Dental Practice* 14, no. 1 (2013): 100–103. <https://doi.org/10.5005/jp-journals-10024-1279>.
- 115 Dennis, Holly. 2018. *The Importance of Building Codes*.
- 116 "Searchable Platform for Building Codes." UpCodes. <https://up.codes/viewer/utah/ibc-2015/chapter/3/use-and-occupancy-classification#3>.
- 117 "Calculating Occupant Load - NFPA." <https://www.nfpa.org/~media/Files/Code%20or%20topic%20fact%20sheets/CalculatingOccupantLoadFactSheet.pdf>.
- 118,120 Thackeray, Thomas. 2012. *Evaluating Occupant Load Factors for Business Operations*. Worcester Polytechnic Institute. Professor Milosh Puchovsky, M.S., Project Advisor.
- 119 Ballast, David Kent. *NCIDQ Reference Manual*. Sixth edition. PPI, n.d.
- 122 Openshaw, Scott, and Allsteel Erin Taylor. "Ergonomics and Design. A Reference Guide." *Environmental Health and Safety*. Allsteel, 2006. <https://ehs.oregonstate.edu/>.
- 123 "Searchable Platform for Building Codes." UpCodes. <https://up.codes/viewer/building-code-2016/chapter/31/special-construction>.

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- <https://osheaclinic.com/dental-crowns/>

- https://www.google.com/search?q=ba49cb01b00d66bbe4d04ef19223c850&tbm=isch&ved=2ahUKEwirik7ji-9D0AhUGvBoKHQ23AUkQ2-cCegQIABAA&oq=ba49cb01b00d66bbe4d04ef19223c850&gs_lcp=CgNpbWcQA1C_IVi_IWCrJWgAcAB4AIAB8QGIaA0DkgEFMC4xLjGYAQCgAQGqAQtn3Mtd2l6LWltZ8ABAQ&sclient=img&ei=ifKuYeuqDlb4ao3uhsgE&bih=945&biw=1196&client=safari#imgrc=NwDTznYbqgg53M

- - https://www.google.com/search?q=dental-clinic-interior-design-x-ray-room-machine.jpg&client=safari&rls=en&source=Inms&tbm=isch&sa=X&ved=2ahUKEwio_sXdrND0AhWt_7sIHfYfwC6wQ_AUoAXoECAEQAw&biw=1196&bih=945&dpr=2#imgrc=Z1_alS5CHr6MgM

- <https://www.pinterest.com/pin/558376053806486399/>