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Exploring Therapeutic Design of Outdoor Landscape for Medical Buildings Enabled by Wisdom: A Case Study of the Fifth People's Hospital of Chongqing

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Abstract: The outdoor landscape design of medical buildings affects the healthcare experience of patients and the work environment of medical staff. Therapeutic landscapes contribute to the recovery of patients and provide a comfortable, convenient, and safe outdoor space for both patients and healthcare professionals. This article analyzes the concept, classification, design necessity, and smart enhancement methods of therapeutic landscapes. By combining the case study of the wellness landscape design of the Fifth People's Hospital of Chongqing, it derives insights into therapeutic landscape design, such as the rational use of natural elements, the construction of pedestrian space systems, the arrangement of specialized botanical gardens, the integration of multiple therapies, and the application of smart technologies. The aim is to promote the development of therapeutic outdoor landscape design for medical buildings.

Keywords: Medical buildings; Smart empowerment; Outdoor landscapes; Therapeutic

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1. Concept of therapeutic landscapes

The healing aspect of landscapes refers to the positive impact that landscape design and environmental creation have on people's physical, psychological, and spiritual well-being. It helps people relieve stress, relax, and promote overall health. This healing landscape is particularly important in the medical building environment, as it provides a better healing space for patients. The concept of healing landscapes originated in the early 1980s [1]. Ulrish, an American environmental psychologist, studied the relationship between natural landscapes and patients' recovery. Later, Gesler, an American geographer, formally introduced the concept of healing landscapes at the 1990 Norwegian International Medical Geography Forum [2]. Healing landscapes, a type

of landscape, aim to restore patients' physical and mental health through plant configuration, landscape sketch design, and cultural symbol expression [3]. Healing landscapes, also known as healing gardens or recuperative gardens, are natural and cultural landscapes in outdoor activity spaces designed based on users' psychological and physiological needs. By integrating with the surrounding natural environment, they create an ecological, recuperative, and natural outdoor space, providing a safe, comfortable, and beautiful recuperative medical environment that restores bodily functions.

2. Classification of therapeutic landscapes

Therapeutic landscapes are generally classified into medical gardens, experience gardens, meditation gardens, rehabilitation gardens, and horticultural gardens [4]. Medical gardens focus on patients' physical, psychological, and spiritual needs, providing an outdoor space for restoring bodily functions and regaining health. Experience gardens emphasize creating an outdoor activity space for patients. Meditation gardens prioritize patients' psychological needs, offering a serene garden for contemplation and rest, reducing mental and psychological stress. Rehabilitation gardens are equipped with facilities that help patients restore motor functions, aiding in their recovery through daily exercise. Horticultural gardens allow patients to participate in gardening, alleviating irritability and psychological pressure through work and enabling them to feel positive energy in the growth and changes of plants.

3. Importance of outdoor therapeutic landscapes in medical buildings

As specialized buildings, medical facilities are primarily used by patients, healthcare workers, and visitors. Patients, as the main users of the environment, are often physically weak and emotionally sensitive, prone to anxiety and unease. They have a significant need for healing landscapes that can alleviate emotional stress and contribute to their recovery. Healthcare workers, facing high work pressure and intense mental stress, also require a relaxing and stress-relieving space amidst their noisy medical work. Visitors, such as family members, need an environment that eases their minds and provides a venue for communication. Therefore, recuperative landscapes become the optimal choice for outdoor medical building landscapes. With the primary task of treating patients, the outdoor landscapes of medical buildings, as an extension of indoor spaces, should also aim to assist in patient treatment. By evoking positive emotions and reducing negative ones through natural environments and cultural features, these landscapes provide an outdoor healing space for users' physical and mental recovery.

4. Healing properties of landscapes enabled by smart technology

With the continuous deepening of China's intelligent development and the national focus on sub-health, landscape design has gradually shifted its focus to the integration of digital landscapes and spaces, emphasizing the restoration of mental health and highlighting the functionality of landscapes [5]. As an outdoor extension of treatment and healing spaces, it is particularly important to utilize smart technology to enhance the healing effects of medical building outdoor landscapes on patients and their families. The healing properties of landscapes enabled by smart technology are primarily reflected in the following aspects:

(1) Smart environmental monitoring and control

Smart technology can monitor the temperature, humidity, light intensity, and air quality of the outdoor

environment of medical buildings in real-time, and adjust them through intelligent systems to optimize the ecological functions of the landscape space and enhance its comfort. By creating a comfortable natural environment through intelligent environmental control, the healing properties of the landscape are improved.

(2) Multi-sensory stimulation in landscape design

Smart technology, combined with the natural environment, provides patients with a multi-sensory healing experience. For example, intelligent devices can adjust the sound of water features, lighting colors, and regulate plant fragrances to enhance the healing effects of the landscape. Additionally, interactive landscape installations such as smart seating and biofeedback equipment can monitor users' physical states in real-time, provide personalized healing solutions, and improve the rehabilitative effects of the environment.

(3) Smart interaction and rehabilitation support

Outdoor smart interactive devices offer users an immersive rehabilitation experience. For instance, intelligent rehabilitation equipment that can automatically adjust its difficulty based on patients' health data is installed, and it can also provide real-time feedback on users' health data to medical staff. Virtual horticultural activities utilizing VR technology are set up to distract patients from their pain.

(4) Smart enhancement of barrier-free design

Smart technology can enhance the accessibility and adaptability of landscapes for elderly and disabled patients, providing them with more humanized healing spaces. For example, intelligent navigation systems can help patients quickly find their destinations. Smart seating can offer patients personalized resting spaces.

5. Analysis of the landscape design of the Fifth People's Hospital of Chongqing

5.1. Project overview

The project is located in the Danzishi area of Nan'an District, Chongqing. The site is bordered by residential land on the west, a residential community on the south, and a natural mountainous area with rich vegetation but a steep slope on the east. The mountainous terrain is relatively complex. On the west side lies a natural river, Dashaxi, which has poor water quality and vegetation, as well as a weak riverbank. The main users of the site are hospital patients and their families, surrounding residents, hospital staff, and a small number of tourists.

5.2. Outdoor spatial layout

The project design is guided by the ideology of ecological civilization construction and adopts the design concept of "looking at the mountains, managing water, leaving space, integrating, and being pleasant." The goal is to create a high-quality medical environment and build a landscape environment that combines medical care with a love for nature and mountains. By integrating three functional blocks: an ecological wetland park, a hospital in a garden, and a mountain health park, the design aims to create an ecological demonstration zone for health and wellness featuring "one mountain, one river, and one park", as shown **Figures 1** and **2**.

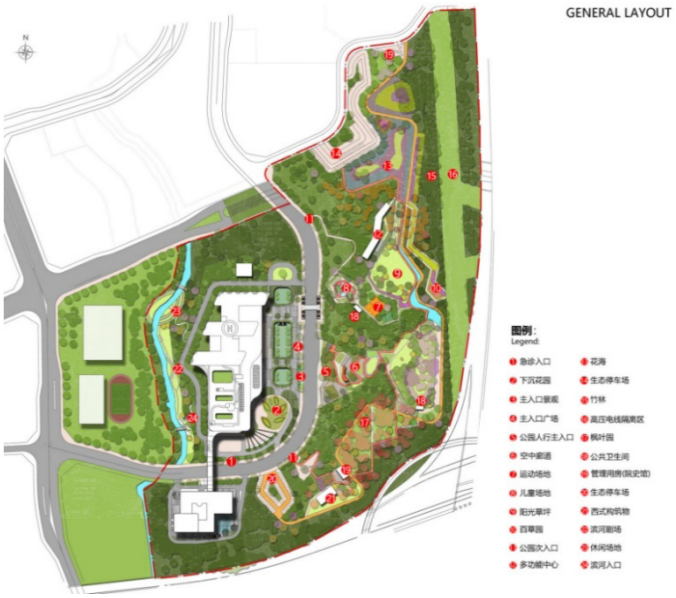

Figure 1. General plan (Image source: project design text materials)

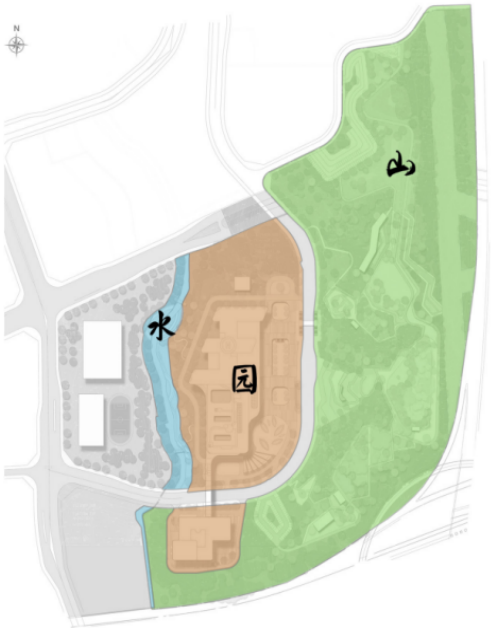

Figure 2. Overall layout (Image source: project design text materials)

(1) One mountain: Embrace the scenery at the foot of Panlong Mountain and wander through the ecological health park. With ecology and nature as the main theme, integrate health culture to create a regional park with rich activities and comprehensive facilities that serve urban residents.

(2) One river: Build a wetland art greenway and play the harmony of ecological music. Focus on water management, ecological construction, and outdoor experiences to create a modern and leisure-oriented ecological riverside landscape area.

(3) One park: Gather humanistic care, beautiful environment, and health culture to build an international,

modern, smart, and garden-style hospital.

5.3. Features of landscape design

The project takes ecology and nature as the main theme, integrating health and wellness culture to create an ecological space full of natural experiences. It allows people to fully engage with nature, achieving harmony between heaven and humanity, and promoting harmonious coexistence with nature. Combining the operational model of "commerce driving the park, and the park supporting the hospital", it fully embodies an ecological scene where the hospital is within the park, and the park is within the hospital. Together, they create a landscape environment that integrates medical care with health and wellness.

(1) Forest therapy

Forest therapy relies on rich forest landscapes, forest air environments, ecological cultures, and other primary resources. It purifies the air, reduces noise, generates negative oxygen ions, and has other functions that affect human physiological health, as well as regulatory effects on human psychology. It is complemented by corresponding health and wellness, as well as medical and recreational facilities, to carry out forest recreation aimed at self-cultivation, nourishing the mind, and delaying aging.

(2) Ecological health and wellness

Relying on a good ecological system and natural environment, projects such as forest bathing, fitness trails, healing gardens, healthy diets, forest tea houses, and sports health are carried out. These achieve the five healing effects of nourishing the body, mind, nature, wisdom, and morality, thereby having a therapeutic effect on physical, psychological, temperamental, intellectual, and moral aspects.

(3) Cultural health and wellness

Combining the cultural characteristics of Chongqing's Bayu culture with the hospital's historical and cultural heritage, unique cultural venues are established to provide cultural experiences and learning exchange spaces for the health and wellness community. This aims to achieve spiritual healing, enhance happiness, and establish a positive and optimistic mindset.

(4) Sports health and wellness

Relying on the forest environment and ecological advantages, sports health and wellness fitness trails, fitness areas, basketball, table tennis, and badminton courts are constructed. Yoga, leisure Tai Chi, forest exploration, and other activities are carried out to cultivate the body and mind, allowing the spirit to unite with the body, thus realizing the healing properties of the landscape.

5.4. Smart applications

The project adopts a three-dimensional landscape design, introducing a green environment into the hospital through forms such as rooftop gardens, terraced green spaces, and corridor spaces. By utilizing smart technologies like intelligent irrigation systems and environmental monitoring equipment, the ecological functions of the environment are optimized in real-time, ensuring an ecologically healthy and healing environment for patients. Smart interactive spaces are set up, providing personalized rehabilitation support for patients in real-time through intelligent interactive devices such as biofeedback equipment and smart rehabilitation appliances. Additionally, interactive sensor-based signage is installed, featuring diverse functions and interesting designs, to meet the accessible navigation needs of patients.

6. Insights into therapeutic design of outdoor landscapes for medical buildings enabled by smart technologies

6.1. Valuing the therapeutic benefits of natural elements

The natural environment can alleviate patients' anxiety and stress, improve their emotions, and promote physical recovery. Natural elements in landscapes include plants, water bodies, and lighting and shadows. Through photosynthesis, plants release oxygen, enhancing air quality and beautifying the environment. The graceful forms and flowing sounds of water bodies create a serene landscape space, helping patients relax and unwind. Natural changes in lighting and shadows bring warmth and vitality to patients. As natural elements exhibit different landscape effects with seasonal changes, they offer varying experiences to patients, stimulating their perception and interest in nature and enhancing their psychological identification with the recuperative environment. Outdoor landscapes of medical buildings should actively incorporate surrounding natural elements, emphasizing natural features while minimizing the impact of artificial facilities. The ecological and social values arising from the design of natural and artificial elements should be recognized. By fully tapping into the therapeutic functions of natural elements and cleverly integrating them into outdoor landscapes, a comfortable, serene, and vibrant healing space can be created for patients and their families, promoting physical and mental recuperation.

6.2. Constructing a reasonable walking space system

The walking system in the outdoor space of medical buildings serves as the primary outdoor activity path for patients. Its reasonable planning and design can guide patients to engage in moderate activities, helping them better integrate into the natural environment during their recovery process, promoting physical recovery, relieving psychological pressure, and improving emotional states. A reasonable walking space system should fully consider the diverse and humane needs of patients. In the design process, attention should be paid to seamless indoor-outdoor connectivity, ensuring easy access to the outdoors and enhancing the utilization of outdoor spaces. Furthermore, road widths and slopes should meet barrier-free design requirements, accommodating easy passage for wheelchairs or those with mobility issues. Paths should extend into natural landscapes, enabling patients to fully immerse themselves in nature during walks, promoting interaction with the natural environment and experiencing its therapeutic power. Additionally, rest nodes, such as benches and pavilions, should be set up along the paths, providing patients with leisure spaces where they can take breaks, admire beautiful scenery, breathe fresh air, and enjoy the tranquility of nature, thereby relieving psychological pressure and improving emotional states. By carefully designing the walking space system, patients are provided with a safe and convenient activity space, aiding them in regaining health and vitality in a natural environment.

6.3. Arranging specialized botanical gardens

Plants emit scents that can enter the human body through the lungs and skin, exerting beneficial effects on disease prevention, physical strengthening, and longevity. For instance, the fragrance of camphor trees can dispel rheumatism and relieve pain. Specialized botanical gardens feature a single plant or a specific type of plant, such as a medicinal herb garden, an aromatic garden, a rose garden, or a meadow dotted with flowers [6]. Medicinal herb gardens cultivate plants with medicinal properties. Herbs like rosemary and lavender can soothe nerves and reduce anxiety, while plants like honeysuckle and mint have detoxifying effects that help enhance patients' immunity. Signs introduce the medicinal effects of these plants, allowing patients to learn about traditional Chinese medicine while admiring the plants.

Aromatic gardens utilize olfactory stimulation for therapeutic benefits. The fragrance of plants can soothe

nerves, reduce anxiety, improve sleep quality, and even alleviate pain to some extent, promoting patients' physical and psychological recovery. Rose gardens are filled with the scent of roses, relaxing tense nerves and unwinding the mind. Patients can stroll through the flower paths, immersing themselves in the space of roses, releasing inner fatigue, and rejuvenating their minds with the healing power of roses. Meadows dotted with flowers often feature a colorful natural tapestry of native wildflowers and weeds, blooming with different flowers throughout the seasons, creating a serene and vivid natural atmosphere. Botanical gardens, with their natural and wild landscapes and diverse plant species, become an ecological space with tremendous healing functions [7].

6.4. Integrating multiple therapies

In the outdoor landscape design of medical buildings, various healing therapies can be cleverly integrated to create a multifunctional physical and mental healing space. By comprehensively applying horticultural therapy, aromatherapy, traditional Chinese medicine's five-element therapy, naturopathy, color therapy, and more, the ornamental, functional, and healing aspects of the landscape are enhanced. By setting up a horticultural area, patients can participate in planting and caring for plants, promoting communication among patients, and allowing them to relax and engage in physical activities while experiencing plant growth. Planting fragrant and non-toxic plants can stimulate patients' olfactory systems to varying degrees, utilizing their scents to soothe emotions and reduce stress, achieving the effects of aromatherapy. Incorporating areas for experiencing traditional Chinese medicine external therapies such as massage, scraping, and moxibustion in the landscape helps patients relieve physical discomfort and promote physical health. Rational utilization of natural elements like sunlight, air, and water in the landscape allows for the design of open lawns, clear water bodies, and comfortable lounges, unleashing the relaxing effects of naturopathy. Different colors of plants are arranged in the landscape design, and plant colors are reasonably matched to create a healing visual experience by leveraging the varying impacts of plant colors on human emotions. For instance, red plants can stimulate the respiratory system and promote blood circulation, green plants help relax nerves and alleviate stress, while white plants are beneficial for lowering blood pressure and soothing emotions.

6.5. Integration of smart technology with healing landscapes

With the emergence of new technologies and concepts such as artificial intelligence, cloud computing, big data, and virtual reality, the technical means of landscape design have undergone corresponding changes. Smart landscapes represent the soul of modern landscapes, and the healing aspect of hospital landscapes can also be achieved through intelligent technology [8]. For example, virtual reality technology can provide patients with specific healing virtual spaces tailored to different psychological issues, not only utilizing the positive guiding role of the natural environment but also enhancing the immersive and personalized experience with smart technology. By introducing the Internet of Things and artificial intelligence technology, a rainwater collection and water circulation system can be established, along with various interactive devices, enabling people to perceive changes in the natural environment and rebuild an intimate connection between humans and nature. Technologies like the Internet of Things, big data, and artificial intelligence allow for real-time monitoring and analysis of environmental data, optimizing landscape design and better meeting patients' health needs.

7. Conclusion

The healing design of outdoor landscapes for medical buildings not only satisfies patients' physiological needs but

also focuses on their psychological and social demands. By rationally utilizing natural elements, constructing a walking space system, arranging specialized botanical gardens, integrating multiple therapies, and adopting smart technologies, a healthy, comfortable, and therapeutically beneficial healing space environment can be created, providing patients with a sanctuary for their physical and mental recuperation and fully unleashing the therapeutic functions of medical buildings.

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Disclosure statement

The authors declare no conflict of interest.

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