Medical Tourism Contents Strategies Using VR/AR for the Chinese Patients Visiting Korea

-With Emphasis on the Chinese Peoples Medical Tourism for Cosmetic Surgery-

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Abstract

This study was conducted to suggest the medical tourism contents strategies using VR·AR for the Chinese patients visiting Korea. If you develop medical tourism contents for cosmetic surgery with VR·AR based on the understanding of characteristics and traits of Chinese visitors, it would contribute to the development of medical tourism for cosmetic surgery. The Chinese people prefer Korea after Japan for medical tourism. This statistics is for all medical departments, but Korea is No. 1 for cosmetic surgery. They visit Korea for cosmetic surgery not just because of the Korean Wave and the geographical proximity, but also because of their trust in Korea's advanced technology in cosmetic surgery. The Chinese people tend to be doubtful, so they choose to visit Korea for medical tourism only when they are referred by trustworthy acquaintances with experience. The existing 2D images could not provide fully reliable consultation before the surgery, whereas the 3D images using the VR·AR technology would reassure the patients who are anxious about the surgery and provide accurate before and after images for the patients to make decisions fully informed. Therefore, this study classified the solution strategies based on the VR·AR technology into nine types: 3D images considering the characteristics of medical tourists from China for cosmetic surgery, their selection factors, anxiety relief, trustworthiness of clinics, trust with physicians, saving consultation time, urban strategies, reassurance, judgment and decision.

Keywords: VR·AR, Medical Tourism, Cosmetic Surgery, 3D, Chinese People

1. Introduction

It is not an exaggeration to say that Korea has the most competitive medical facilities and technologies compared to any other countries in the world. The medical tourism industry boomed from the early 2000s thanks to the Korean Wave, but it has struggled for the past few years due to the THAAD. The number of Chinese tourists in Korea decreased sharply due to

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the THAAD revenge in March last year, but the number of tourists for pleasure is increasing again this year. [1] Both tourism and medical tourism would shift to restoration soon. What is important is that the medical tourism market would not boom again if there are no contents developed to satisfy the returning tourists.

Naked Lab, a start-up based in San Francisco, California, recently developed the Naked, a 3D full-body scanner for homes, for the first time in the world and introduced it on the 1st of this month. [2] The Naked consists of a mirror and scale for the full body. When the user stands on the scale, it turns 360° in 15 seconds. The sensor in the mirror scans the entire body to create 3D images. Naked Lab transmits the scanned images to the user’s Smartphone or computer and displays the changes in body fat and muscles in different colors so you can see how the body changes at a glance. Also, Cal-Com Data of Taiwan has developed Hi-Mirror. Hi-Mirror captures the face with the camera embedded on top of the mirror to show on the mirror the results of analysis of blemishes, wrinkles, and dark circles. It also shows whether the skin was damaged when the user applied cosmetic products.

Korea has recently joined the development of AI surgeons. The government has come together when Seoul Asan Medical Center and Kakao Brain, an AI startup, to develop Dr. Answer, a medical AI. If the contents in the medical field combine with virtual or augmented reality, it would generate synergies in the field of medical tourism. In case of the medical field, it is used for healthcare, surgical simulation, and rehabilitation training and studies are conducted for wearing HMD to create 3D images. Also, MRI or CT images are combined with the actual images for surgeries. [3]

The Chinese people have the tendency to try the products and purchase them only when they can trust them. Therefore, it is necessary to develop contents strategies that provide them with virtual experience before the real experience. The largest number of Chinese people comes to Korea for cosmetic surgery. If there is a Chinese visitor for cosmetic surgery, for example, an avatar can be selected to simulate the surgery on it for the visitor to see how they would look after the surgery with the virtual reality contents. It would improve the satisfaction of medical tourists from China and contribute to the development of Korea’s medical tourism industry.

First of all, this study will analyze the use of VR·AR in the medical field. Second of all, it will examine the status and characteristics of medical tourism for the Chinese people with emphasis on the field of cosmetic surgery, which takes the largest part of medical tourism among the Chinese people. Last of all, it will suggest the medical tourism contents strategies for the Chinese people using VR·AR.
2. Theoretical Background of VR·AR

Virtual reality (VR) offers an experience as realistic as the reality in a virtual space, while augmented reality (AR) is adding virtual images to a real space as a combination of virtual reality and reality. In VR, users can feel as if they are actually experiencing something, so they can be immersed in the situation and have trust in the experience. According to Gartner, AR is a technology that has been derived from VR and overlaps the virtual images over the real world that is visible to the user, showing the user the information added to the real world in a combined image in real-time. [4]

Also, VR has three factors: 3D space, real-time interactivity, and self-projection. The 3D space refers to how the 3D visual space and 3D auditory space created by computers spread out around the user. The real-time interactivity refers to how the user can interact with the avatar or an item within the software in real-time. The self-projection means that the user is projected in the environment he/she experiences. [5]

VR is widely applied to the medical field. It is particularly applied to surgical simulation to display and manipulate a patient’s internal organ or tissues, suggest the most effective surgical technique, or show the inside of the parts to be operated with matching or overlapped layers of images for accurate, trustworthy surgical operations. In fact, special devices are required in order to show AR, such as the goggles or HMD (Head-Mounted Display), aviation simulators, PDAs, Smartphones, etc. As AR is based on the real world, its biggest benefit is that it is realistic and the use of AR allows an attractive experience of seeing, hearing, touching, and interacting with the digital information or contents related to the interested object or place through all five senses. [6]

Using the AR technology, 3D Avatar, and digital human technology, each individual patient’s appearance after the cosmetic surgery can be shown through virtual simulation. It would be helpful for anticipating the results accurately and saving time for consultations. [7]

Based on this background, this study sought to discuss how to use VR and AR for the medical tourism of the Chinese visitors for cosmetic surgery considering the characteristics of Chinese people.

3. Status and Analysis of VR·AR in Medical Field

The VR·AR technology is widely used in games, 3D movies, aerospace, automotive industry,
tourism industry, education, national defense, robotics, architecture, and in many other industries. In medicine, it is applied to healthcare, surgical simulation, rehabilitation, and diagnostic imaging and it is even expanded to the field of psychological therapy. Also, studies are being conducted for 3D diagnostic imaging wearing HMD and simulated surgeries are conducted with MRI or CT images combined with the actual and/or virtual images. [8] Some of the medical devices that apply the VR·AR technology include devices that transmit the CT-MRI images to a tablet PC compatible with AR to use in actual surgeries and devices that assists rehabilitation therapy using vital signs, such as the brain waves and electromyogram and HMD.

Recently, the field of cosmetic surgery has completed a system that produces simulated 3D images using 3D virtual simulation. You would doubt about the results of cosmetic surgery if you look at the 2D Photoshop images, but the 3D images are more reliable to reassure the patients. The 3D virtual system is an advanced device that reconfigures the high-resolution images of three different spots into 3D images that are used to judge the pre-surgical conditions, measure the heights, length, and 3D volume of certain body parts, and display the new appearance after surgery more specifically and precisely. Also, it resolves the limitations of generalized examples that cannot be applied to all people as each person has slightly different physical structures. In case of patients for cosmetic surgery, one of their biggest concerns is how their appearances would change after the surgery and whether they would look the way they want, and 3D simulation creates the visual image of how they would look after the surgery so they can be satisfied by their looks after the surgery. [9]

The following Fig. (1) lists the fields where the VR·AR technologies are applies.

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
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<tbody>
<tr>
<td>Medical/Dental Training</td>
<td>The surgeons are trained to perform the surgery using the surgical tools actually connected to the simulator and receive Haptic feedback as they practice.</td>
</tr>
<tr>
<td>Pre-Surgical Planning</td>
<td>3D radiology images and computer workstation tools for engineering and planning the surgical procedure.</td>
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<tr>
<td>Computer-Aided Surgery systems</td>
<td>3D images are displayed over the surgical areas to assist the surgery.</td>
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<tr>
<td>Interactive 3D Diagnostic Imaging</td>
<td>The medical image data are captured and manipulated for data analysis and quantitative comparisons in the 3D format.</td>
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<tr>
<td>Radiation Treatment Planning and Control</td>
<td>Radiotherapy engineering-3D engineering and control systems necessary to match the patient’s anatomical structure.</td>
</tr>
<tr>
<td>Medical Education</td>
<td>Medical history, 3D Anatomy, corpses for virtual biopsy, procedure training, ER simulation, examination training, etc.</td>
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<tr>
<td>3D Visualization for Telemedicine</td>
<td>Data sharing for remote consultations and additional diagnosis of other physicians using radiation images, tumor examination, remote patient examination, and specialist consultations.</td>
</tr>
<tr>
<td>Telesurgery</td>
<td>Computer-aided surgery from remote sites requiring prediction algorithms and 3D surgical planning.</td>
</tr>
<tr>
<td>Rehabilitation and Sports Medicine</td>
<td>Simulation environment, occupational therapy, orthopedic therapy, ergonomic designs, orthopedic surgery, and sports medicine for assessment and rehabilitation.</td>
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<tr>
<td>Disability Solutions</td>
<td>AR environment control system to treat autism and other cognitive disorders.</td>
</tr>
<tr>
<td>Neurological Evaluation</td>
<td>Standardized simulation for cognitive processing, stroke, memory disorder, motor disorder, and assessment of advanced functions.</td>
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</tbody>
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Source: Re-excerpted from Jung Woo Hyun’s dissertation.

As shown here, the VR-AR technology is applied to various medical areas. It would take further research and development to use VR-AR for commercial purposes, but the medical tourism contents would be improved with the development of VR-AR technology and infrastructure. Therefore, it would be necessary to develop medical tourism contents tailored for the Chinese visitors on the foundation of infrastructure.

### 4. Status and Characteristics of Medical Tourism for Chinese

As there are nearly 60 million Chinese people who travel abroad for medical services, the market has reached 1 billion RMB (166.7 billion KRW) in value. Yangcheng Evening News, a local press in China, reported on the 31st that the number of Chinese patients receiving medical services overseas increased from 20 million in 2006 to 50 million in 2014 by quoting Boers Data Research Center, a market information consulting firm. [10]

According to China’s industrial information network, the market scale of medical tourism agencies in China has expanded sharply from 0.21 billion RMB in 2012 (approx. 35.3 billion KRW) to 1.56 billion RMB in 2015 (approx. 252 billion KRW). The scope of medical services for medical tourism has widened from high-income classes to the middle class and younger consumers born in the 1970s~90s. Considering that 71% of tourists are female, you can assume
that medical tourism for cosmetic surgery is in trend. With the influence of vital marketing among the Chinese people, many Chinese tourists in Korea always have cosmetics on their shopping lists. Korea’s cosmetic products are so popular that they wait in lines at the duty-free shops to buy them. This means that they are interested in the appearance and the consumption of cosmetic products also affects medical tourism for cosmetic surgery. As shown in the chart below, the most cases of visit for medical tourism are through acquaintances. As many Chinese people tend to be doubtful, it is natural for them to visit for medical tourism when they have trust in the experience of predecessors. Therefore, it is effective to develop contents using VR·AR to earn their trust through virtual reality.

[Fig 2] Medical Tourism Information Collection Path

China is seeing a shift in consumer trends with the economic development. The new groups of consumers leading the trends are Balinghou and Jiulinghou. According to the 6th National Census of 2015, China’s ‘Balinghou’ and ‘Jiulinghou’ take 0.4 billion of the population and they are growing into the mainstream of economic activities and the major group of consumers. They are called the ‘little emperors’, meaning that they have owned everything they want without any scarcity. They prefer online shopping through e-commerce and explicit consumption for personality and vanity beyond mass-consumption. Explicit consumption is also known as conspicuous consumption and refers to consumption for show-off, rather than
utilization of products or services. [11]

They are also the target consumers of Korea’s cosmetic products and medical tourism for cosmetic surgery. As they were born when China’s economy has begun to develop in stability, they have been able to focus on consumption for personality regardless of cost and prefer consumption for unique experiences. Therefore, it would be useful to develop contents for experience through VR·AR.

The table below shows the departments of medical services sought by foreign patients in Korea and the nationalities of foreign patients.

[Fig 3]. Status of Medical Imports by Country of Foreign Patients

Source: Korea Health Industry Development Institute
Considering the profit of medical services provided to the foreign patients by nationality, the biggest profit comes from the Chinese. The type of tourism of the Chinese visitors who visit Korea is medical tourism for cosmetic surgery and Korean medicine. Their interests in medical tourism are drawing an acclivity with the impact of Korean Wave and more people are seeking cosmetic surgery based on what they see on the Korean TV shows. This is not because of the geographical proximity, but also because of their trust in Korea’s technology in cosmetic surgery. The fact that it is easy to see the Chinese tourists at the tourist attractions who are wearing the sunglasses to hide the scars of double-eyelid surgeries or bandages on the noses after nose surgeries manifests that medical tourism is popular among the Chinese people. With the development of Chinese economy, more Chinese women are interested in how they look and their consumption is increasing in cosmetics, cosmetic surgery, and fashion. According to the study of In Soon Jun, Dong Gyoo Min, and Kyung Sook Lee on the properties of Chinese people’s medical tourism to Korea, Korea has a positive image because of the Korean TV shows and singers, but there is no definite image in relation to the medical tourism. Therefore, a solution to resolve this problem would be to develop contents using the VR·AR technology. The Chinese people have the tendency to prefer imitation and give their full trust once they trust something. The premise for medical tourism for cosmetic surgery which requires referrals of close acquaintances is trust. Therefore, the use of VR·AR would resolve the problem of satisfaction and trust for medical tourism.

5. Medical Tourism Contents Strategies for Chinese People’s Cosmetic Surgery Using VR·AR

The Korean Wave is still widely beloved among the Chinese people and the Korean TV shows and K-POP motivate the young men and women in China to come to study in Korea. Also, many of them seek cosmetic surgeries in Korea to resemble the Korean celebrities they admire. The Korean cosmetic surgery clinics have faced difficulties due to the impact of THAAD and the Chinese government’s strict retaliation action for the past few years, but the young men and women of China were an exception. They watch the Korean TV shows, listen to the Korean songs, and watch the Korean movies on SNS to learn what the latest trends are in Korea and purchase the Korean goods directly from the Korean stores. They admire the Korean Wave and pick Korea as one of the places they must visit. It is urgent to develop tourism contents to satisfy the needs of these young generations of China. Therefore, this
study was conducted to suggest strategies for the development of medical tourism contents for the Chinese people.

First, many young people in Korea and China pursue beauty on the appearance. Cosmetic surgery took the biggest part of medical tourism of Chinese people and the medical tourists who visited Korea last year complained about communication issues (25.0%), lack of related tourism programs (17.3%), and lack of interests (16.1%). These problems would be resolved to a certain degree with VR·AR. Considering that the younger generations today are accustomed to 3D images and like to see objects 3-dimensionally, the field of cosmetic surgery can apply the VR·AR technology to contribute to the development of medical tourism for cosmetic surgery.

Second, the Chinese people believe that their dignity and respect are important, so they avoid giving straightforward advice to others and like to use metaphorical and figurative poetic languages. Therefore, VR·AR should be applied to develop medical tourism contents suitable for the Chinese people.

Third, the most important aspect of medical practice is trust. Therefore, hospitals and clinics can show the inside and outside, the facilities, and directions through VR·AR via websites so the tourists can find information about the hospitals and clinics and their surrounding environment to be reassured and feel friendly to them.

Fourth, each cosmetic surgery should be performed after simulating how each patient would look after the surgery in VR. In other words, each operation should be performed after each patient has built trust with the surgeon.

Fifth, if the VR·AR technology and the 3D avatar digital human technology can be applied to simulate and visualize how each patient would look before the surgery, it would be possible to predict the results to save consultation time and build trust with the patients.

Sixth, the following image shows the medical tourism destinations preferred by the Chinese people. Korea was ranked 2nd place. However, this ranking is for the entire field of medicine. The Korean government should use the VR·AR technology to promote medical tourism and develop locally tailored contents.
Seventh, the VR technology is used to create and display the worlds that do not exist in reality or that are hard to see for yourself, so it will be suitable for showing the virtual images of patients after their cosmetic surgeries to build trust in the field of cosmetic surgery. Also, the AR technology can combine the real-time images of real spaces with the images created on the computer for the expansive experience of the real world. In this respect, it would be effective for medical tourism for cosmetic surgery.

Eighth, the VR·AR technology would be able to eliminate the limitations with the existing technology’s visualization of face after surgery in terms of depth, projections, perspectives, and 3D expressions. Also, it would realize the most ideal results considering the overall proportion and harmony of face and the aesthetic standards of each patient. Also, the system that
interacts with virtual objects would allow deep immersion not available in the actual environment to assist the patients’ decision-making process.

We need various strategies and promotion programs to build the infrastructure to attract the Chinese people to Korea for cosmetic surgery. China is also quickly developing its IT and VR-AR technologies. However, Korea’s already known for the advanced technology in cosmetic surgery and with the medical tourism contents for cosmetic surgery using the VR-AR technology, Korea would be able to have dominance as a provider of medical services for cosmetic surgery for anyone coming from the Greater China and around the world.

6. Conclusion

The purpose of this study was to suggest the medical tourism contents strategies using VR-AR for the Chinese patients visiting Korea. First, the concept of VR-AR technology was explained and the application of VR-AR technology was discussed. The VR-AR technology is applied to various areas, so it was analyzed to which areas of medicine it is applied. The VR-AR technology is applied to many fields of medicine, but this study’s strategies are applied to the medical tourism in cosmetic surgery, which is the most preferred field of medical tourism in Korea among the Chinese people. Therefore, this study suggested the strategies to develop contents based on the VR-AR technology to attract more medical tourists from China for cosmetic surgery and the analysis as to how the VR-AR technology would be suitable for the tendencies and characteristics of the Chinese people.

First, the Chinese people’s consumer traits are changing along with the development of Chinese economy. The biggest group of consumers for medical tourism for cosmetic surgery is the young people of China, especially ‘Balinghou’ and ‘Jiulinghou’. They are the major consumer class in the Chinese society. They are financially stable and focus on enjoying leisure life and realizing their dreams. They have unique personalities compared to those who were born in the 60s~70s and they are leading the latest trends. As the newer generation, they pursue beauty on the appearance. Therefore, the VR-AR contents would be suitable for their traits. [12]

Second, most Korean hospitals and clinics appoint medical coordinators to provide consultation services when the Chinese people come to Korea for cosmetic surgeries, but it is actually not very easy to provide perfect translation services to address all of their needs. Also, most Chinese people prefer using vague and figurative expressions when making conversations. Therefore, it is easy to misunderstand what they truly want. The best way to
resolve this problem is to provide foreign language features and apply the VR·AR technology.

Third, some of the most important factors are the trustworthiness of the surgeons and the clinics. The VR·AR technology can be applied to share information about a clinic’s medical staff, equipment, operation, follow-up services, and other services to earn trust and help the patients with their decision-making process.

Fourth, in any case of medical practice, the most important condition is the trust between the surgeon and the patient. It is crucial in all departments of medicine, but it is particularly important for the younger generations that are seeking to be more beautiful through cosmetic surgery. It would be possible to earn their trust by showing 3D images of how they would look after the surgery using the VR·AR.

Fifth, the VR·AR technology for consultations can not only save time, but also contribute to each patient’s satisfaction by showing personalized images. If the existing consultations based on 2D images caused anxiety, the 3D images using the VR·AR technology would contribute to eliminating the anxiety.

Sixth, China has special regional characteristics. For example, northern people and southern people have slightly different views about beauty on the appearance. Therefore, the VR·AR technology would be able to promote medical tourism services for cosmetic surgery tailored for each city in China.

Seventh, the VR·AR technology approaches patients in a form of experience in the virtual setting, so it can contribute to their psychological reassurance and decision. As the Chinese people are doubtful and may be psychologically unstable away from home, the VR·AR technology can effectively show the simulated outcomes of surgery for reassurance.

The strategies to develop medical tourism contents for cosmetic surgery using the VR·AR technology considering the characteristics of Chinese people would contribute to the constructive development of cosmetic surgery in Korea.

The limitation of this study is that there was lack of preceding studies and resources as the VR·AR technology is neither complete nor active in Korea’s medical tourism industry. The significance of this study, on the other hand, is that it attempted to develop the strategies to develop medical tourism contents for cosmetic surgery using the VR·AR technology considering the characteristics of Chinese people.
References

[9] https://www.youtube.com/watch?v=rQuZoskqV0