

News Release

Title

Demonstration experiment of telemedicine using ultrasonography and telerehabilitation with 5G communication system in aging and depopulated mountainous area

Key Points

- Telemedicine using a mobile ultrasound system and telerehabilitation were conducted using 5G communication systems in aging and depopulated mountainous area and were compared with LTE communication.
- The results showed that 5G communication systems can transmit information such as 4K images and ultrasound images with higher quality and lower latency than LTE communication systems.
- The improvements in data transmission also affected the subjective evaluation of the doctors and physical therapists.

Summary

A research group headed by Hitoshi Hirata, designated professor, department of personalized medical technology revealed that telemedicine and telerehabilitation with 5G communication systems in aging and depopulated mountainous area can be performed using multiple high-definition images with lower latency compared to LTE, and these affected the subjective evaluation.

This research received a grant from the Ministry of Internal Affairs and Communications; Development and demonstration for the realization of local 5G and other technologies for solving local problems [grant number 17 in the fiscal year 2020], and conducted as collaborative research with Shinshiro City, Shinshiro Municipal Hospital, NTT Data Institute of Management Consulting, Inc., NTT DOCOMO, Inc., and NIPRO Corporation,

5G communication systems are used in healthcare, automated driving, 4K/8K high-definition video transmission, smart homes, and other applications because they provide high-speed, large-capacity communication and low latency. More emphasis was placed not only on improvements in communication technology as was the progression of communication systems in the previous generation but on the creation of a human-centered society through information systems. On the other hand, the aging of the population in depopulated areas has many challenges, especially due to limited human healthcare resources. 5G communication systems are required to realize more effective utilization of healthcare resources through telemedicine and rehabilitation.

The project team has constructed a video transmission and healthcare treatment system using 5G communications at aging and depopulated mountainous areas in Shinshiro City, Aichi Prefecture.

The team has demonstrated that in telemedicine using a mobile ultrasound imaging system and telerehabilitation, multiple high-definition images can be transmitted with lower latency compared to conventional LTE communications. We also confirmed that these differences improve the subjective evaluation of physicians and physical therapists.

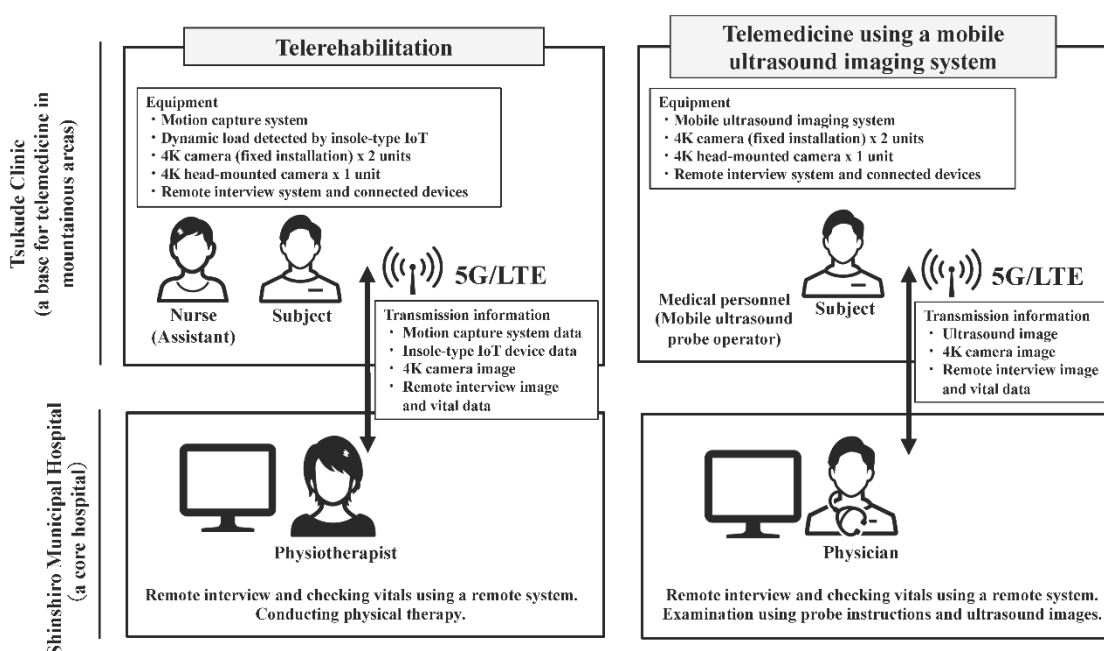
Research Background

The aged population is currently at its highest level in human history. The problem in an aging society is the growing population in need of healthcare and the limited resources of healthcare. While technological breakthroughs in the medical and nursing fields have brought many benefits to the healthcare sectors, the economic burden continues to increase. In recent years, there has been remarkable progress in information and communication technologies, leading to innovations in various areas. 5G communication systems are capable of high-capacity, high-speed communication with low latency, and their use is expected to transform medicine.

We report a demonstration experiment in which industry, academia, government, and the private sector collaborated to conduct telerehabilitation and implement telemedicine using a mobile ultrasound imaging system with 5G communications in a depopulated area in mountainous terrain.

Research Results

Telemedicine using a mobile ultrasound imaging system and telerehabilitation were conducted between a core hospital and a clinic in a depopulated mountainous area using a 5G communication system.



In telemedicine, a medical worker operated the mobile ultrasound probe on a subject at a clinic in a mountainous area, and a physician staying at the core hospital was examined with probe instructions. In the remote rehabilitation, a physical therapist performed rehabilitation on five residents. In both demonstrations, the physicians or physical therapists were subjectively evaluated in terms of image quality and transmission delay for 5G and LTE, respectively.

Regarding the delay time, the two physicians' responses for 5G communication were the delay was "acceptable" and it was "rather acceptable". In contrast, for LTE communication, both respondents answered that the delay was "not acceptable."

In telerehabilitation, six responded that the quality of the 4K image transmission was "good" for 5G, and only three responded "acceptable" for LTE. In LTE, only three respondents answered that the quality was good. Regarding the delay time, five 5G users answered that the delay time was "acceptable," while only one LTE user answered that the delay time was "acceptable."

It is clear that the 5G communication system is capable of transmitting high-quality video and other information with lower latency than LTE, and that this affects the subjective evaluation of physicians and physical therapists.

Evaluation of video quality in telerehabilitation

Communication system, Resolution, Transmission rate	5G, 4K, 15M	LTE, HD, 5M	LTE, 2K, 5M	LTE, 4K,5 M
Good	6	3	3	3
Rather good	1	4	3	4
Bad	0	0	1	0

Evaluation of delay time in telerehabilitation

Communication system, Resolution, Transmission rate	5G, 4K, 15M	LTE, HD, 5M	LTE, 2K, 5M	LTE, 4K,5 M
Acceptable	5	4	3	1
Rather acceptable	2	3	3	6
Not acceptable	0	0	1	0

Research Summary and Future Perspective

From this demonstration experiment, it was confirmed that the 5G communication system enabled telemedicine using a mobile ultrasound imaging system and telerehabilitation with lower latency and higher quality images and other

information, and also affected the subjective evaluation of physicians and physical therapists.

In the future, we would like to evaluate technological innovations in the medical and health fields not only in terms of indicators of technological sophistication, but also in terms of the value they provide to healthcare professionals and patients, and work to resolve issues in the healthcare fields in aging and depopulated mountainous areas.

Publication

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