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A KNEE MONITORING DEVICE AND THE PREFERENCES OF PATIENTS LIVING WITH OSTEOARTHRITIS

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Abstract: This examines knee biomechanics in terms of patient function, prosthesis design, cruciate ligament retention, alignment, and fixation of the tibial component. While design and surgical technique for total knee replacement progress, a better understanding of the characteristics of joint loading, stress distribution, and the biologic response of bone to stress will provide the potential to improve both function and implant longevity.

INTRODUCTION

Total knee replacement is an operation frequently needed by hemophiliac's patients, which greatly improves their quality of life. This operation, however, carries a higher risk of bleeding and infection for hemophiliacs than it does for osteoarthritis sufferers. It is advisable to implant prosthetic components using antibiotic-loaded cement. It is essential to maintain a level of 100% of the replacement clotting factor for 2 weeks. Hematological treatment must be established, depending on the patient's factor levels and other pharmacokinetic parameters such as recovery and half-life, optimal doses and treatment time**.**

COMPONENTS USED:-

HARDWARE REQUIREMENTS:-

Force sensor
Flex sensor
MEMS sensor
ADC
LCD Display
Android Integration unit
UART
Buzzer
Power supply unit

SOFTWARE REQUIREMENTS:-

Embedded C
Arduino IDE

EXISTING SYSTEM

A replacement knee can never be quite as good as a natural knee – most people rate the artificial joint about three-quarters normal. Most knee replacements aren't designed to bend as far as your natural knee. Although it's usually possible to kneel, some people find it uncomfortable to put weight on the scar at the front of the knee.

PROPOSED SYSTEM

- MEMS strain-sensing device for the monitoring of loads acting upon an artificial knee implants. The main goal of evaluating the strain is to help surgeons on the alignment of prosthesis, which can improve the knee balance and provide a follow up tool to help monitoring the artificial knee along its lifetime assuring the overall surgery quality.
- Flex sensor is used for monitoring the bending position of the leg. If the sensor finds the bending position continuously the buzzer will be in ON and AIU sends a Emergency messages to the relatives.
- By monitoring strain (Force sensor) one can determine local tissue deformations and stresses in bone and cartilage. Strain sensors in implants have been used to measure net joint loads.
- The sensor value will be monitored continuously and display in the LCD
- If the value reaches the threshold automatically sends the Emergency Messages to the relatives' mobile phones by using AIU technology.

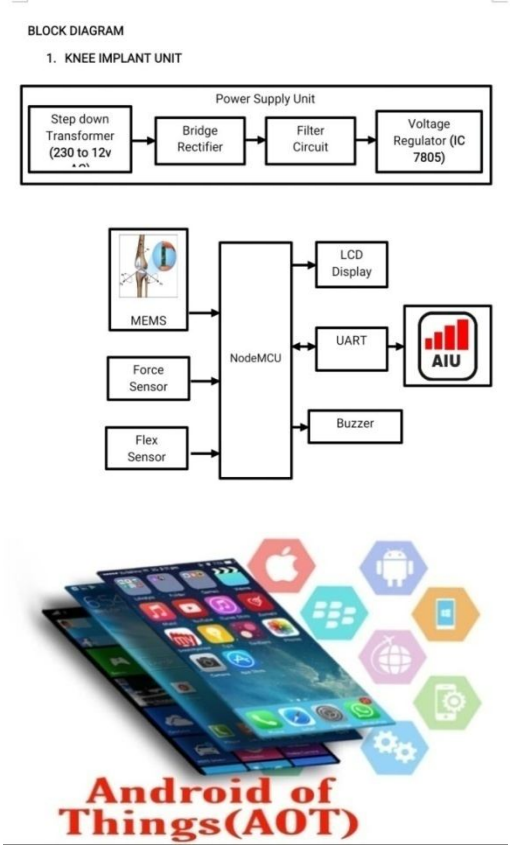

Figure 5: Knee monitoring using acoustic sensor [28]

FUNCTIONALITY:

The technology is seen as an alternative way to provide supervision when away from a clinical setting to "reinforce what you learn and helping you to remember how to do it" and hence, maintain achieved benefits without *slip back into bad habits*: The physio tells me that I'm walking too much on one side or the other side of my foot, and I do that, but I'm simply myself not aware of it, so if there was something that was just reminding me, that would be brilliant.

Patients also discussed the advantages of having an ongoing data gathering of their movement function, especially when they would be away from their clinicians, and how this could prove beneficial in their subsequent visits in terms of management and planning ahead: I mean it's like having a physiotherapist by your side so when you do go and see her, him or her, they've got all this, they've been there with you and so they can say, well, this is what you were doing, I was there. Not really, but sort of, because of the machine.

In relation to how participants perceived the usefulness of objective data in the treatment decision-making process, it was felt that objective information would help them during the consultation by providing a clear explanation of their current status beyond their subjective description and perceptions: So having something which can be more precise rather than you trying to explain is I think a very attractive step forward really because it gives proper data rather than your understanding of what it is you're doing .

This would also provide clinicians with extra information to tailor treatment to each patient: Help the physio to give you the best exercises which are geared just for your needs. On a more personal level, there were also thoughts that the use of the technology could help patients to make more effective use of their time during the rehabilitation process: I think it could also save the need to attend a hospital, doctor or physio appointment, if the data could be transmitted using the internet, downloaded and transmitted that way, because I know they do it for, particularly in remote communities. They do ECGs and all that remotely. The data could be sent to your healthcare professional, and they could say, yeah, that's fine, we don't need to see you or I think perhaps we'd better have a, you'd better come and see us. Analogously, the accessibility of objective information on movement function could speed up the assessment process: A quicker, less pain, hopefully, at the end you will have more information, your problem will be sorted out quicker, whereas if you're going the traditional route you're talking about months sometimes. Participants also highlighted how the use of technology could, in addition to saving time, reduce costs for themselves: I'd say cost and/or time because, time is a personal cost and you can spend hours waiting for X-rays, waiting, going to see physios, waiting, going to see your GP who spends ages for his letter before it gets to the consultant who's away for three months who when you finally, all of that is time and it's tedious and it's phone calls and it's, so I think time and cost .

ADVANTAGES

- Total knee replacement can increase mobility and decrease pain in people who have an injured or arthritic knee joint.
- More than 90 percent of patients who have knee replacement surgery experience less pain and greater mobility in their knee after the procedure.

DISADVANTAGES

- You may also be aware of some clicking or clunking in the knee replacement.
- You may have some numbness at the outer edge of the scar to begin with. This usually improves over about two years but it's unlikely that the feeling will completely return to normal.
- A replacement knee joint may wear out after a time or may become loose.

CONCLUSION

This paper should encourage adoption and development of wearable technology to support rehabilitation of patients with osteoarthritis. It is pivotal that technological development takes into account patients' views in that it should be small, light, discrete, not 'appear medical' or challenge the identity of the user. Derived data should be available to patients and clinicians. Furthermore, wearable technologies should be developed to operate in two modes: for exercise guidance and assessment only, and for unobtrusive everyday monitoring. The information obtained from this study should guide the design of new technologies and support their use in clinical practice.

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