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Tele-orthopaedics: a snapshot of services in Australia

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Abstract

Health services in the United States and Europe have reported that tele-orthopaedics saves significant patient travel time, reduces time off work, increases satisfaction with care and in some scenarios reduces the cost of care. Less is known about the role of tele-orthopaedics in Australia. The aim of this study was to explore Australian-based tele-orthopaedic services, and to identify the barriers and enablers associated with these services. We used a qualitative case study methodology where specific services were identified from multiple sources and invited to participate in a structured interview. Nine tele-orthopaedic services contributed to the study. Telehealth activity in each service ranged from one to 75 patients per week, and service maturity ranged from three months to 10 years. Services were used predominantly for fracture clinics and peri-operative consultations. The majority (78%) of services used videoconferencing. Two services used asynchronous methods to review radiographs without direct patient involvement. Tele-orthopaedics was found to be disruptive as it required the redesign of many care processes. However, all services found the redesign feasible. Staff resistance was a commonly cited barrier. Further, imaging repositories from multiple imaging providers complicated access to information. Key enablers included clinical champions, picture archiving and communication systems, and the perceived benefit to patients who would avoid the need for travel. Whilst it appears that tele-orthopaedics is not widely utilised in Australia, recognition of the barriers and enablers is important for the development of similar services.

Keywords

Orthopaedics, orthopedics, models of care, telemedicine, telehealth

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Background

Tele-orthopaedics involves the delivery of specialist orthopaedic services across a distance – usually between an orthopaedic surgeon and a patient. Established tele-orthopaedic services have reported benefits similar to other speciality applications of telehealth, namely that tele-orthopaedics can save significant travel time, reduce time off work,[1] and increase the patient's satisfaction with their post-operative care when compared with traditional methods.[2] In some scenarios, tele-orthopaedics can also reduce the cost, from a societal perspective, of providing orthopaedic consultations, due to more efficient consultation methods.[3]

In Australia, Medicare (Australia's national health insurance scheme) introduced rebates for telehealth with a goal of increasing the uptake of telehealth.[4] Further, many of Australia's state health departments also provided incentives or a policy directive to increase the utility of telehealth for the delivery of healthcare – one such example is Queensland Health's strategic plan.[5] Increasing access to care using telehealth is consistent with the strategic goals of international healthcare providers (e.g. US Department of Veterans Affairs[6]). Despite funding and policy support, there is little published in the academic literature (apart from several studies on Queensland services[7, 8]) about tele-orthopaedics in Australia.

The aim of this study was to identify and describe characteristics of operational tele-orthopaedic services and identify barriers and enablers to implementing and running these services. It is hoped the findings of this study may assist with the development of new orthopaedic models of care, which include telehealth.

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Methods

We used a qualitative multiple-case study methodology[9] with structured interviews as the data source and each tele-orthopaedic service as the unit of analysis. Interview participants were representatives from tele-orthopaedic services currently operating in Australia. Any service with a participant willing to be interviewed was included in the study.

Recruitment

Tele-orthopaedic services were identified using a snowball sampling method. Services were initially identified from a number of sources including an online telehealth provider directory,[10] recruitment advertising (telehealth co-ordinators' meeting, the Australasian Telehealth Society's newsletter), academic literature, and services known to the study team.

Potential participants were contacted by phone and email to confirm they used telehealth in their practice and to ask if they would be willing to participate in the study. An orthopaedic surgeon from the service was initially approached and if they were unavailable, another employee involved in the service, such as the telehealth co-ordinator, was contacted and invited to participate.

Data collection and analysis

Structured interviews between 10 and 30 minutes were conducted by the same post-graduate qualified telehealth researcher (MT) between February 2017 and May 2017 with consenting participants. During the interviews, participants were asked the same 20 questions, which were designed to describe characteristics of the tele-orthopaedic model of care and elicit opinions on barriers and enablers to tele-orthopaedics (see Appendix 1). All interviews were conducted by telephone except two (one in-person interview and one email interview). Interviews were digitally recorded. Participant responses were entered in chart form to facilitate structured analysis. Once entered, the data were returned to the interviewee to validate their responses. Results were reported narratively. Human Research Ethics Committee approval was given to conduct this study.

Results

A total of 10 separate tele-orthopaedic services were identified, and nine were willing to be interviewed and included in this study. Services were located in Northern Territory, New South Wales, Queensland, Western Australia, and Victoria. Four of the interview participants were orthopaedic surgeons with the remainder a mix of allied health or administrative staff involved in the delivery of tele-orthopaedic services.

Models of care

Real-time video consultations between the orthopaedic surgeon and the patient were performed in seven (78%) services. The remaining two services used store-and-forward consultations where the orthopaedic surgeon did not see the patient, but instead reviewed radiographs. In one of these services the patient was recalled only when clinically warranted. In the second service, the orthopaedic surgeon co-ordinated patient management via local hospital staff and a general practitioner. Services were used for fracture clinics (56%, $n = 5$) and peri-operative consultations (44%, $n = 4$).

All services used hub-and-spoke models of care with the clinician at the hub site and patients attending from spoke sites. The hub was primarily a major hospital with spoke sites: either more regional hospitals, remote community health facilities, or on occasion the patient's home. Most models (78%, $n = 7$) involved public hospital services.

Typically, a local medical officer, nurse, or physiotherapist accompanied the patient during the video consultation. Two services stated the patient may attend the video consultation by themselves. The consultant-end included an orthopaedic surgeon, registrar or fellow in all models.

Regional spoke sites could usually obtain x-ray imaging, but if magnetic resonance imaging (MRI) or computed tomography (CT) scans were required, the patient travelled to regional hubs or metropolitan centres. Consultants could log into a central picture archiving and communication system (PACS) to access the images of the patients they were consulting with, otherwise images would be electronically sent by email before the consultation. In one service, the hub site received images by compact disc.

Progress notes were kept in a traditional manner at the consultant-end, either directly into a hard copy paper chart, or handwritten by clinicians and later scanned to an electronic file. The patient-end kept their own notes on file for review purposes. Requests for tests, prescriptions, and workers' compensation slips were handled at the patient-end if personnel such as a local medical officer was present; otherwise, the specialist would fax or scan a copy to the remote site for the patient to have immediately, while also sending a hard copy by regular mail. Three participants stated that the consultant had established relationships with remote pharmacies allowing prescriptions to be sent directly to the patient's local pharmacy for medication retrieval.

Additional characteristics of the included tele-orthopaedic services are summarised in Table 1.

Barriers and enablers

Staff. Staff were seen as both a barrier and enabler of tele-orthopaedics. Staff or executive resistance was a commonly cited barrier. One interviewee stated that the

Table 1. Characteristics of tele-orthopaedic services in Australia.

CODE	Length of Service	Estimated Average Consults per Week	Types of Care	Patient-end Participants	Access to Patient Information and Images	Plaster Process
NSW1	4 years	20	Fracture clinics and pre- and post- surgical review	Patient and physiotherapist	Combination of electronic & hard copy written notes, chart physically pulled, electronic imaging, access to private imaging facilities, discharge summaries go on electronic system (accessible on remote end)	Physiotherapist applies and removes plaster, slings, splints, scaphoids, waterproofs, and long arms. Unable to remove sutures at the remote end, so registrar uses dissolvable stitches. Cannot do cylinder cast at remote end (but planning to do more training). Remote site does not always have more than one person so long-leg plaster, etc. are challenging
NSW2	1.5 years	20	Review of simple fractures, store-and-forward review of radiographs, subsequent recall of patient where indicated. Wound reviews via real-time video consultation	Patient and nurse	Electronic medical record accessible within health district. Remote site uploads images to PACS server	Site-dependant: some sites have a physiotherapist one day a week or more that can do plastering; nurse at some sites can do plastering; at some remote sites patient would have to come to hub site for plastering (and more often for first presentation or children)
NSW3	1.5 years	1	Initial consultations for total shoulder replacements, tears, repairs or dislocations. Post-surgical review	Patient, occasionally with family member/spouse (one case where patient did not have computer so went into GP practice and GP was present)	Can access certain providers' images online, otherwise patient physically sends compact disc, or requests electronic copy of report/results without images	N/A (hospital would fit sling pre-discharge)
NT1	3 months	8	Fracture clinic (slowly starting post-surgical review)	Patient and one of the following: registrar, physiotherapist, occupational therapist, medical student or nurse	Images loaded through PACS system from remote hospital	Remote hospital plaster technicians do basic plastering. Occupational therapist does splinting or some more complicated plastering, otherwise patient must go to major hospital
QLD1	4 years	26	Fracture clinic (some infections of bone/joint, penetrating wounds) and pre- and post-surgical review	Patient and one of the following: medical officer, nurse practitioner, or physiotherapist	Private radiology provider at remote site transmits images to health department PACS. Hard copy charts at remote end, just booking form at hub end	Orderlies do basic plastering. Nurse Practitioner removes stitches

(continued)

Table 1. Continued

CODE	Length of Service	Estimated Average Consults per Week	Types of Care	Patient-end Participants	Access to Patient Information and Images	Plaster Process
QLD2	5 years	75	Fracture clinic trauma, paediatric and adult (some arthroplasty, pre- and post-surgery)	Patient with physiotherapist and occupational therapist (3-way teleconference at times), or only physiotherapist, nurse, administration officer, medical student, or patient alone	Radiographs on computer, patient information on paper-based chart	Nurses do wound review, dressings, remove stiches & pins, site cleans and dressings. Some remote sites have plaster technicians, elsewhere a doctor in an emergency department at a remote hospital is required to plaster. Person takes out own K-wires on occasion, need to go to hub site to have them put in
QLD3	5–6 years	25	Post-operative review, some initial consultations	Public: patient and nurse. Private: patient on own (may travel to primary care physician to use facility)	PACS system, can access most private providers if necessary	Plastering done at hub site, physiotherapists at remote sites can do some splinting, larger regional centres have occupational therapists
VIC1	10 years	3	Post-surgical review, (where no treatment needed), mostly store-and-forward review of imaging – orthopaedic surgeon advises referrer or local GP on management	Patient and general practitioner	Log in to radiology providers in region, IT staff integrated patient information onto screen	General practitioner removes plaster, or if they are unable to, the patient travels to one of the twice weekly fracture clinics or rooms at hub site
WA1	3.5 years	7	Pre- and post- surgical review	Patient and healthcare worker of some kind (i.e. nurse, physiotherapist, doctor, registered nurse)	State has public health PACS system; all government hospitals networked, but in one remote site images are done by private provider (hard to get access to)	Remote or regional general practitioners do simple procedures, very provider-specific

NSW – New South Wales; NT – Northern Territory; QLD – Queensland; VIC – Victoria; WA – Western Australia
GP – General Practitioner; N/A – Not applicable; IT – Information Technology.

reluctance of patient-end nurses to undertake the additional duty of accompanying a patient during a video consultation was a barrier to establishing their service. Whereas a champion who supported telehealth was often reported as an enabler. An orthopaedic surgeon championed most (56%, $n = 5$) services. One service highlighted that having a dedicated telehealth project manager drove the development of their tele-orthopaedic service. Staff perceiving a benefit to the patient in terms of improved access and saved travel time was a motivation for tele-orthopaedics. For one service, an unfortunate patient event involving a long drive to the appointment later deemed unnecessary was the motivation for establishing a tele-orthopaedic service. For another service, the initial inertia of an orthopaedic surgeon to practise was overcome when they performed their first teleconsultation. Subsequent to this, the surgeon has become a proponent of tele-orthopaedics.

Imaging. PACS and teleradiology were identified as enablers of tele-orthopaedics. However, on occasions, the non-centralised access to imaging repositories from multiple providers caused difficulties. Miscommunication between sites about having the complete patient imaging history available before the teleconsultation, or waiting for discs of images to be sent by mail were reported as barriers.

Physical examination. Two participants expressed concerns over not being able to examine their patients in person in order to grade more subjective measures such as strength. This concern was overcome in some services using a trained allied-health staff member on the patient-end.

Processes. Tele-orthopaedics was found to be disruptive as it required the redesign of many processes of orthopaedic care such as imaging, prescribing, documenting (e.g. workers' compensation certificates), plastering, simple procedures and physical examinations. However, all services found it feasible to redesign processes for tele-orthopaedics. Good co-ordination between the remote site and consultant-end was stressed as important in order to manage timing of teleconsultations and the flow of patients.

Cost. Cost barriers to tele-orthopaedics were commonly identified (44%, $n = 4$). Lack of financial resources to employ additional staff to provide administrative support or accompany the patient during the video consultation was cited as a barrier.

Some cost barriers described in these Australian services were overcome with the assistance of either state or federal government funding. Three participants reported that the availability of a funding model was an enabler or the reason the tele-orthopaedic service started in the first place. This funding was either in the form of initial infrastructure costs (i.e. technology set up for the department at no cost to them), fee-for-service funding, or incentive payments.

Tele-orthopaedics was often (33%, $n = 3$) considered inefficient, relative to traditional models of care. According to one telehealth programme manager, Medicare remuneration for orthopaedic telehealth is disproportionately low when compared to the amount of work involved, and this may contribute to the relatively low uptake of tele-orthopaedics.

Legal. Confusion around legal responsibility was identified as a barrier. Issues included medical liability, privacy and storage of images.

Communication. Communication issues between the clinician and patient (e.g. elderly patient, non-native English speaker) that might exist under traditional face-to-face consultations were thought to be exacerbated by telehealth. However, only one service reported that technology was the cause of communication problems, whereas the majority thought technology issues were of minimal concern.

Discussion

This study indicates that tele-orthopaedics can be practised successfully for certain aspects of orthopaedic care such as fracture clinics and peri-operative review consultations. However, it also reveals that within Australia, tele-orthopaedics is not widely used for the delivery of orthopaedic care. Reasons for the slow uptake are consistent with the reasons for telehealth in general – including clinician's reluctance to practise,[11] additional staff required to accompany the patient during the video consultation and the resultant additional cost,[4, 12] and the inability to perform a physical examination.[13, 14]

Previous research has cited having a clinician at the regional site to accompany the patient and aid in the consultation as a success factor in managing surgical cases by telehealth.[15] This study emphasises the importance in telehealth of having a good relationship with the remote site, and the possibility of having trained staff to carry out physical examinations on behalf of the consultant. Research participants of this study noted that every remote site is set up slightly differently and knowing these nuances is important.

When barriers were discussed during interview, no participant mentioned patient willingness as a barrier to tele-orthopaedics. One of the factors that makes tele-orthopaedics a particularly appealing model of care in Australia is the large distances that can be saved in patient travel. One interview participant stated that patients had been travelling 1000 km from Borroloola to Darwin (12 hours driving one way) in order to see an orthopaedic surgeon. After tele-orthopaedics was introduced, long-distance trips like these have been saved for patients. It was evident from this study of Australian services that the benefit to the patient in terms of saved travel time was

a major motivation for tele-orthopaedics. In specialities such as orthopaedics where patients are travelling for relatively frequent check-ups (e.g. fracture clinics), telehealth can provide an option to avoid unnecessary travel at times and also result in major savings to the healthcare system due to reduced travel costs.[7]

In the current study, many responses indicated a belief that video consultations were less efficient than equivalent face-to-face interactions. This was in terms of the administrative overheads (e.g. scheduling), additional personnel requirements and longer consultation times. All of these services used real-time video consultations. Although not measured, store-and-forward consultations – where the orthopaedic surgeon does not see patients but reviews radiographs and co-ordinates care through a local medical officer – are likely to be more efficient than either face-to-face or video consultations. Due to their increased efficiency, store-and-forward consultations (as opposed to other modalities of telehealth) have the greatest potential to reduce waiting lists for specialist outpatient services.[16] Similar models of care, based on store-and-forward review without patient contact, have been described in a UK service for post-operative knee and hip arthroplasty[17] and a Canadian service for acute orthopaedic injuries.[18]

International studies have described tele-orthopaedics being used for emergency department consultations.[18-22] In the current study no models of care for trauma or emergency department orthopaedics were reported. In our experience, this occurs between clinicians on an informal basis in the Australian context.

Limitations

It is likely there are operational tele-orthopaedic services that were not identified and included in this study. Given the very small number of participants, generalisabilty of findings is not possible. Some contacted services had previously run a tele-orthopaedic service but were not currently running any of their services via telehealth and as a result they were not included in the current study. These services may provide rich information on the barriers to tele-orthopaedics in Australia. The use of allied-health led clinics to provide tele-orthopaedic care is a model that is increasingly being used in Australia.[23] The current study was limited to consultant-led services.

Conclusion

Tele-orthopaedics is not widely practised in Australia. However, the current study has demonstrated that a proportion of orthopaedic care (e.g. fracture clinics and peri-operative review consultations) can be successfully delivered by telehealth. Reasons for the low uptake of tele-orthopaedics are consistent with the reasons for low uptake of telehealth in general. Staff resistance was a commonly cited barrier. Further, imaging repositories from multiple imaging providers complicated access to information. Key enablers included clinical champions, PACS and the perceived benefit to patients who would avoid the need for travel. Whilst it appears that tele-orthopaedics is not widely utilised in Australia, recognition of the barriers and enablers is important for the development of similar services.

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Declaration of conflicting interests

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Ethics

This research was approved by The University of Queensland Human Research Ethics Committee (Approval Number 2016001547).

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APPENDIX 1 Tele-orthopaedic service interview questions

1. *What types of care are provided by your service? (fractures, pre-surgical review, post-surgical review, ORIF, etc.)*
2. *How do you access images and patient information?*
3. *Do you use video conferencing? Which software? What is the technical set-up?*
4. *What is the EMR or charting process/how do you record notes?*
5. *What areas do you serve?*
6. *Who accompanies the patient, who is on the patient-end?*
7. *Who is on the consultant-end? (What is their level of experience?)*
8. *What tests are done? (CT, MRI, X-ray, blood)*
9. *How do you order further tests?*
10. *Where is the nearest site for imaging? CT, Ultrasound, X-ray?*
11. *What is the plastering and splinting process? Who does it?*
12. *How do you do procedures? (Put pins in/out? Referral process?)*
13. *How do you give patients certificates? (Workers' compensation, time off work, etc.)*
14. *Do you prescribe any medications using telehealth? If so, how?*
15. *Public or private funding? Other funding model?*
16. *What is the activity data?*
17. *What barriers/problems do you encounter with this service?*
18. *How did the service start? ('Champion' of telehealth?)*
19. *Are you aware of any other tele-orthopaedic services in Australia?*
20. *Any other comments on the service?*