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Remote Clinical Consultations in Restorative Dentistry: A clinical service evaluation study

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Abstract 200 words

Introduction

Specialist consultant services in the NHS-UK provide a decision-making support service to other health professionals. There is a drive to deliver this service in a more patient-centred, cost-effective and efficient manner. Remote Clinical Consultations (RCC) using secure live super-fast internet connectivity and high-resolution, multi-channel audio-visual streaming has the potential for the delivery of this service.

Aim

To conduct a clinical service evaluation to assess the viability and efficiency of conducting a RCC for the management of primary care referrals in restorative dentistry, compared to an in-person consultation.

Design

A RCC was conducted for every participating patient and immediately followed with a 'verification' in-person consultation.

Materials and method

23 patients of even gender distribution participated in this study across the three specialisms of restorative dentistry. A thematic questionnaire was completed by each member of the study intervention team and the patient after each consultation.

Results

In all the cases the consultant was able to conduct an effective and safe clinical consultation, not inferior to an in-person process, regardless of gender and age. The GDP, the nurse and the patient were able to participate effectively in the process and with each other.

Conclusion

This proof-of-concept study suggests that the RCC concept is a feasible way of delivering specialist consultations in restorative dentistry with high levels of patient acceptability and that it can be delivered in a practical and simple manner.

In Brief Points

There is a drive to deliver patient-centred consultations in a more cost-effective and efficient manner.

This service evaluation highlights that it is feasible to conduct Remote Clinical Consultations with high levels of patient acceptability and that it can be delivered in a practical and simple manner.

Introduction

The UK Government is seeking reforms to provide health care that is more patient-centred. The 2011 NHS report 'Future Forum Patient Involvement and Public Accountability' states "the fundamental purpose of the Government's proposed changes to the NHS is putting the patient first", and requires "patient involvement to the extent that shared decision making is the norm"[1]. A sentiment that is further emphasized in the UK Government's response to the subsequent consultation 'Liberating the NHS: no decision about me, without me', that highlights the need for a practical implementation of the proposal so that patients can make informed decisions about their care, through the provision of accurate and accessible information and patient involvement[2].

In the UK, general dental practitioners (GDPs) in primary care are supported in the patient-care decision-making process by specialist consultants in the NHS secondary care sector. The consultation takes place as an 'in-person' event in secondary care centres (E.g. Teaching or district hospitals). The primary outcome of the consultation is to provide the patient and the referring dentist with the required specialist advice and a patient-centred care plan for the management of the referred condition. The care plan is in the form of a letter-report and consists of a summary of findings, diagnoses, prognoses and a treatment strategy. This is relayed to the patient verbally during the consultation and in a written letter-report format to the referring clinician, copied to the patient and appropriate stakeholders.

The current consultation process provides the baseline standard against which all other processes should be measured. This standard is based on the *effectiveness* of the process (ability to deliver a specialist outcome) and *safety* (a minimum chance for error) as it relies on an optimal direct personal interaction between patient and consultant. It is focussed around the resources of the secondary care environment, with no regard to the patient's requirement for displacement to this centre and the cost-effectiveness of the whole process. As the in-person consultation currently stands, the sequence of events that take place can be outlined as per Table 1 in the following stages:

An analysis of the relative merits of the current 'in-person' consultation system, suggests the following perceived advantages and disadvantages[3] (Table 2).

From this list for an in-person specialist consultation, it is possible to suggest that in this system *efficiency and effectiveness* is largely compromised. *Efficiency* is compromised by the need for the patient travel to the remote location of the specialist referral centre. A further suggested inefficiencies is the time lag between completion of the consultation and the follow-up with the referring clinical team. *Effectiveness* is equally limited due to the potential for the primary care clinician to misinterpret, not be able to comprehend or be unable to carry out the suggested plan; which may in turn lead to frustration and lack of desired appropriate action.

An alternative system is considered in this report that may provide more patient-centred and better-integrated patient care using Remote Clinical Consultations (RCC). RCCs can operate by using a platform of secure internet-based, high-resolution, multi-channel audio-visual streaming that enables simultaneous sharing of information and communication between primary and secondary care, leading to integrated management of patient care between the three parties (Patient, doctor/dentist and consultant) at the point of specialist treatment planning[4, 5, 6]. The concept of 'no decision made about the patient without the patient' is central to this process, so that the patient is present for all discussions and have an informed say in the decision process.

Patient-centred care is a key driver for the development of tele-dentistry and an example of this, is its use to improve community access to oral health care and eliminate disparities between rural and urban communities [16, 17, 18]. Mills et al. (2014), described patient-centeredness across three dimensions: clinical effectiveness, safety and patient experience; and found that there is a poor evidence of the use of patient-centeredness in dentistry and a lack of agreed indicators against which to measure the quality of care delivery [7]. A recognised aspect of patient-centred care is joint-decision making by all stakeholders, with the patient firmly placed at the centre of this [8]. RCCs shifts the decision-making-process from a one-to-one scenario (clinician-patient, dentist-patient, clinician-dentist) to group decision making with all three stakeholders present in the dialogue in a contemporaneous

manner; a care model that is in line with the need for increased patient involvement in the NHS treatments.

Tele-dentistry holds the potential for facilitating true group-decision making between the three key stakeholders; patient, dentist and specialist consultant. Studies on the factors required for effective group-decision-making have shown that doing so using remote connectivity can be at least as effective as face-to-face in person. Strasser et al. (1992) highlight that a group of three works best when the individual contribution of each person in the group is clear, while groups which had a less structured approach are not as effective as they do not fully utilise the available information [9]. Dougall and Friske (2008) suggested that good communication facilitates the building of trust, helping reduce patient anxiety and enhancing patient satisfaction and compliance [10]. A further study by Martin et al. (2011) highlights that remote, internet-based discussions enable a more relaxed discussion environment between participants than face-to-face encounters [11].

A collaborative system using tele-communication through the use of telemedicine, dental image tools, sharing electronic patient records and video-conference, helps to establish a cooperative diagnosis, treatment planning and professional mentoring in the field of dentistry [12, 13, 14].

Analysis of system requirements suggests that a RCC process must seek to replicate or improve the exchange of all the sensory information in the gold standard (an in-person consultation). Visual and auditory sensory input by the remote participants should be of high fidelity, detailed and comprehensive. Current technology using super-fast and secure broadband connectivity and advanced multimedia communication technology could enable this RCC process. Whilst it is important to ensure that the technology environment is robust and effective, it is equally important that this is kept as simple as possible to avoid intimidation and encourage a relaxed and effective discussion to take place[11].

The aim of this study was to conduct a proof-of-concept clinical service evaluation with the primary outcome of assessing the feasibility and acceptability of conducting remote clinical consultations for the management of primary care referrals in restorative dentistry and a secondary outcome to identify the barriers and facilitators to this intervention. Key to this

evaluation study, is the ability for the same consultant to conduct a standard in-person 'verification' consultation immediately after the RCC intervention. This double consultation eliminated the risk that patient care resulting from the RCC intervention, was not adversely affected; it also provided an opportunity for comparison between the two consultation modalities.

For the purpose of this evaluation, the investigators have identified the core-features of an in-person specialist clinical consultation in restorative dentistry - 'Baseline standard'. The RCC process evaluated in this study is compared to this baseline standard, with the following key features:

- Allows for a full and unimpeded dialogue between the patient (or representative) and the specialist consultant.
- Enables the conduct of a full and appropriate clinical assessment, to include a comprehensive history, clinical examination and required special investigations.
- Enables the establishment of appropriate and accurate diagnoses (including differential) and a prognosis for every diagnosis reached.
- Enables the establishment of a patient-centred and pragmatic treatment options and/or a treatment strategy for the management of the referred condition and any additional diagnoses.
- Enables the preparation and submission of a report to be returned to the patient and the referring dentist following the consultation, that includes the findings of the consultation and the outcomes as above.

Method

The study was designed to assess the primary and secondary outcomes as stated in the aim of this investigation. Patients selection for participation in this service evaluation were under primary care of General Dental Practitioners (GDPs) in the South Yorkshire and Humberside region and that were referred to the Charles Clifford Dental Services (CCDS STH NHS Trust, Sheffield, UK) for a routine specialist consultation under the contracted terms of service provided by CCDS. Patient referrals were limited to restorative dentistry, including the sub-specialties of endodontics, periodontics or prosthodontics. An even distribution of

gender and restorative sub-discipline was sought with a random demographic inclusion, being representative of the diverse nature of the actual service provided. A total of 23 patients (12 F and 11 M) were included in accordance with the inclusion criteria and following a random selection process that stipulated an even gender distribution and an even representation from the three subspecialties of restorative dentistry. The intervention took place in September 2018 over the course of 10 half-day sessions, shared evenly between two consultants. A pathway for this intervention is detailed in Figure 1.

Inclusion criteria

- Patients of either gender and at least 18 years old at the start of the study.
- Patients who are able to attend the clinic for consultation and do not require multi-disciplinary input from other dental specialties.

Exclusion criteria:

- Patients who are unable to give informed consent with no capacity or vulnerable population as defined in ISO 14155 were not enrolled.

Eligible patients were recruited through an invitation letter with a study outline and a patient information sheet. Patients that responded positively to the invitation letter, were invited to attend for consenting prior to the intervention and possible recruitment thereafter. Baseline screening for eligibility was undertaken based on the information provided in the original referral and a more detailed eligibility assessment was conducted on attendance. On the day of the appointment, patients were given the option to participate in this study or proceed with a regular appointment for a standard consultation modality as per routine hospital protocols. All interested patients were consented to the study.

In line with the aim of conducting two consecutive consultations for each patient (RCC followed immediately by an in-person standard consultation), the remoteness of the consultant was limited to a different room within the same building. This did not affect the aim of the study as distance between the consultant and the clinical surgery is not a variable that affects the outcome when using super-fast broadband connectivity.

A diagrammatic representation of the RCC delivery is depicted in Figure 2. The patient was seen in a dental surgery with a GDP and a dental nurse in attendance (the patient's referring dental team). The consultant was in a 'remote' location, which for the practical implementation of this study was located in the same building. In this study, we refer to the collective of individuals participating in the intervention as 'stakeholders' and it includes the patient, consultant, GDP, nurse and an observer (present to provide an independent account of the process). All stakeholders communicated by means of a combination of one-way and two-way live AV communication using secure intranet connectivity, designed to optimise data exchange (Figure 1 and table 3). The total number of clinical staff participating in this study were: Two consultants, eight GDPs and five nurses combined to create two consultant-led teams with a random allocation of GDPs and nurses between them resulting in twelve different combinations of clinical staff. The time taken to undertake the RCC was measured as was the distance travelled by the patient for the consultation as an indication of the contribution to the carbon footprint associated with this.

The RCC was conducted in the manner of a standard in-person process, in line with the principles of a 'baseline standard' as detailed above. The findings were relayed to the patient and confirmation of understanding by the patient and GDP were obtained. The RCC concluded by establishing a diagnosis, prognosis and appropriate treatment strategy. A detailed description of the format and sequence of the RCC process consultation is detailed in table 4.

Both primary (feasibility and acceptability) and secondary outcomes (barriers and facilitators) were assessed through specifically tailored stakeholder questionnaires that were completed by all participants immediately after the intervention in accordance with her/his individual role in the process. All the questionnaires went through an iterative design and validation process to test their appropriateness to extract the required data. The validation was conducted by a mixed group of clinicians that were considered to be representative of the study participants.

The following stakeholders completed the questionnaire after each intervention: The consultant, GDP, patient, nurse and independent observer (Table 5). Each RCC event was

timed from start to finish as was the time taken for the overall RCC. All data from the questionnaires was compiled for each of the responders and categorised thematically to enable classification of the data for effective analysis (Table 6).

Key to the assessment of feasibility, was the ability to deliver a comprehensive patient-management decision (treatment plan) made on the outcome of the RCC examination. The RCC was always undertaken first and the outcome of this was checked and confirmed immediately after through the 'in-person' verification consultation. This process was key to establishing whether the RCC was fit-for-purpose and able to deliver an accurate and comprehensive treatment plan outcome.

For each intervention, every stakeholder (Consultant, GDP, patient, nurse and independent observer) was invited to complete a post-intervention questionnaire. The comments made in response to the open-ended questions (Table 6), were analysed thematically using a deductive semantic approach based on the structure of the questionnaire and the explicit responses and opinions expressed. The six-step thematic analysis process advocated by Braun and Clarke was followed[15]. In addition, we measured the time taken to undertake the RCC and we estimated, from their home post code, the distance travelled by the patient for the consultation as an indication of the contribution to the carbon footprint associated with this.

Results

A total 25 patients were enrolled in the study. One patient cancelled his appointment on the day. One patient was excluded at the start due to an un-reported hearing impairment. The study analysis was undertaken based on data for 23 patients. A 100% questionnaire completion and return were achieved and this was analysed as described in the methodology.

The data analysis revealed the following:

- The number of patients assessed for each sub-specialty were: Endodontics 8, periodontics 7 and prosthodontics 8.

- In 100% of cases, irrespective of the sub-specialty, the consultant was able to conduct an effective clinical consultation through the RCC process. The GDP, the nurse and the observer were able to participate effectively in the process and work effectively with the consultant.
- In 95% (22/23) of patients were able to participate and communicate effectively in the RCC process. In this one case, the RCC process was not completed due to technical problems with the two-way tablet communication channel.
- In 100% of cases, the GDP was able to convey information to the consultant.
- In 100% of cases, the consultant was able to establish and convey effectively all the appropriate consultation outcomes, including the correct diagnoses, prognoses, treatment options and future care pathways. In this way establishing full concordance and agreement in these domains between the two consultation methods.
- 95% (22/23) of patients felt that the RCC project worked well. One patient preferred the in-person as she experienced hearing difficulties.
- 100% of GDPs agreed that there was a scope for having a professional educational experience.
- The majority of the barriers of the study were related to the audio quality 13% (3/23) and visual quality 4% (1/23).

The mean time required to undertake a RCC from start to finish was 30 minutes, excluding the consenting process. Patients attending for the consultations travelled between 1 mile and 24 miles with a mean of 8.5 miles. Considering each appointment attendance as a return journey, and assuming a direct travel route, the total distance travelled by the 23 patients that attended was estimated to be a minimum of 391 miles.

The comments made in response to the open-ended questions (Table 6), were analysed thematically and revealed some further points of interest. More than 50% of patients identified that the RCC process provided a 'reassuring' environment. The environment facilitated good and positive discussions between all the stakeholders, especially the patient, consultant and GDP. The RCC provided fast expert advice with an agreed consultant and GDP opinion and an agreed action plan by end of consultation. In addition, a major

perceived benefit was the ability to save time and travel and associated expenses. Further advantages, noted by responders were: The potential for improved speed of treatment and having two professional dentists undertaking the clinical assessment simultaneously with good discussions between them.

There was an even distribution amongst patients for preference between the RCC or the in-person consultation, with no strong views either way. Patients expressing a preference for the in-person consultation, noted the 'personal' touch as being desirable. Notwithstanding, the potential to save time, travel and associated costs was a major and consistent consideration amongst patients, outweighing any potential benefits from an in-person consultation.

Concerning the clinical feasibility and safety of the RCC procedure, all of the stakeholders confirmed that safety was not compromised at any point. The in-person consultation did not raise any safety concerns of the preceding RCC procedure. Equally, none of the stakeholders felt that the outcome of the RCC was compromised, when compared to the in-person consultation.

Further positive free-text comments from patients (n=4) were: The ability to be involved in the discussion with both the GDP and the consultant and the RCC process being less intimidating than attending a hospital.

Individual patients (n=3), each raised the following concerns about the RCC process: That it would be difficult to make a clinical assessment with accuracy in all instances; GDP practices may not have the necessary equipment to provide this service; and individual patient preference would need to be considered.

Finally, during the interventions, we experienced some minor technical challenges associated with the AV configuration of the set up and occasional loss of connectivity between devices. This was noted by some patients as a challenge that would need to be resolved.

Discussion

We find ourselves in a rapidly changing healthcare climate driven by an ageing population and growing clinical complexity. This is compounded by the need to improve patient-centred decision-making, improve access to oral health care and improve interprofessional collaboration to address rural oral health disparities [16, 17, 18], a need to reduce patient travel and associated CO_2 footprint[Error! Bookmark not defined.], establish accelerated patient-care pathways through managed clinical networks[19] and explore the potential for improved cost-effectiveness in the delivery of health care specialist advice. Remote clinical consultations through high-speed secure live broadband connectivity may provide part of a solution to these challenges.

In the UK, the NHS provides specialist consultant services to primary care clinicians for decision-making support and planning patient care. The consultation takes place as an 'in-person' event at a secondary care centre where the consultant services are based (e.g. Teaching or district hospitals). This model is used ubiquitously for oral health care and other medical services. There is a drive to deliver this service in a more patient-centred, cost-effective, efficient manner, addressing the UK's NHS plan (NHS Long Term Plan v1.2, August 2019)[20] with a commitment to reduce face-to-face outpatient appointments by up to a third over the next five years. It also aims to do so in an environmentally sustainable manner by reducing unnecessary patient travel and the associated carbon foot print from patient travel. Remote Clinical Consultations (RCC) have the potential to offer this service by linking both the primary care clinician and the patient (co-located in the dental practice) to a remote specialist consultant, using super-fast internet connectivity. This enables them to hold a live 3-way patient-centred discussion about the patient's care needs.

Further potential advantages are considered for the use of tele-dentistry in the delivery of RCCs. It is likely to be a more patient centred process; with less inconvenience to the patient that is not required to travel to a remote location; with a faster process from referral to treatment; and enables patients with complex multimorbidity to have longer consultations[21]. A RCC allows for the delivery of a consensual treatment planning process with the GDP and the patient that are present throughout the whole process. A shared database could use smart auto-populating templates for report generation, so that the agreed outcome report could be created within the appointment. RCCs should reduce the

risk of miscommunication between parties and eliminate replication of investigations. There is a distinct potential for professional education as the GDP will be participatory to the process and this could be a major driver for GDP involvement. A RCC can reduce hospital overheads with the elimination of a dedicated clinical surgery and support staff.

The concept of a RCC applied to restorative dentistry arises from an appreciation by the research team of the benefits, limitations and challenges that the current specialist consultation process delivers, as a service to all stakeholders. The clinical research team in this project have assessed these relative merits and consider that a system that connects, via secure internet, the co-located patient and GDP to the remote Consultant, without the need for the patient to travel to the 'consultant' location is a more effective patient-centred service with additional advantages. To address this hypothesis, a clinical service evaluation was undertaken to assess the potential and feasibility of undertaking specialist consultations in restorative dentistry with the consultant located remotely and engaging with the primary care team and patient by means of tele-dentistry connectivity. This proof-of-concept study provides a novel and detailed insight of the feasibility, challenges and stakeholder experiences of using a Remote Clinical Consultation process in restorative dentistry for the provision of specialist consultations in each of the subspecialties of restorative dentistry (Endodontics, periodontics, prosthodontics).

The main outcome from this service evaluation is that a Remote Clinical Consultation in restorative dentistry, as undertaken in this study, is feasible with a high level of patient acceptability and that it can be delivered in a practical and simple manner. We identified that the time taken to undertake the RCC was approximately thirty minutes, considered to be slightly longer than that of an in-person consultation but with the advantage that further objectives have been achieved by engaging directly with the patient's primary care provider (GDP). In this study, we estimated that patients travelled an average distance of 8.5 miles resulting in approximately 391 miles of patient journeys for the 23 appointments. This is a direct contribution to the environmental carbon footprint that can be potentially reduced with the adoption of RCC in a primary care setting in the patient's residential locality.

A thematic evaluation of barriers and facilitators identifies several positive advantages for RCC over in-person consultations. Observations from patients highlighted the reassuring

nature of a consultation with two professionals, engaged in a positive discussion that reached an agreed outcome that could be expedited without further delays. Practitioners benefited from direct guidance of a specialist which also provided an educational element. Patients liked being involved in this discussion and taking a positive participatory role in the process. A major positive perceived finding was the ability to save time, travel and associated expenses through a RCC process. Patients also raised some salient concerns regarding the process that should not be dismissed, in particular regarding the scope of capability of the RCC process and patient preference. Ensuring effective technology was identified for some of the RCC interventions. This specifically related to the quality of the audio and visual set up. It is true to say that this was a relatively amateur and basic configuration designed to provide a proof-of-concept outcomes.

Tele-medicine used for RCCs in restorative dentistry builds on the desirable features of the current in-person consultation service provided by secondary care providers. This study has shown that RCCs have the potential to offer a truly collaborative process by using a platform of secure internet-based, high-resolution, multi-channel audio-visual streaming that enables simultaneous sharing of information and active, engaged discussion between primary and secondary care, leading to integrated management of patient care between the three parties (Patient, doctor/dentist and consultant) at the point of decision making and specialist treatment planning.

The potential long-term benefits from embedding the proposed RCC in routine clinical practice are to deliver a specialist consultation service for patients and their GDPs that is not inferior to an in-person consultation whilst at the same time overcoming the disadvantages of this in-person process (Table 2) with notable advantages in terms of the delivery of patient-centred care and a reduction of CO_2 emissions associated with reduced patient travel.

Analysis of system requirements following this intervention has identified that a RCC process must seek to replicate or improve the quality and thoroughness of the visual and auditory sensory information captured during an in-person consultation. Current technology using super-fast and secure broadband connectivity and advanced multimedia communication technology could enable this RCC process. The system will require a secure

platform with clear regulatory boundaries to comply with clinical governance policies. Moreover, the implementation strategy and use of the RCC system will need financial investment in primary care settings. As a result, GDP practices may have lacked motivation to increase uptake and engagement with the new system.

It is important to highlight that whilst there is emerging support for the efficacy of tele-dentistry, the concept lacks conclusive evidence in terms of effectiveness and cost-effectiveness to make evidence-based implementation decisions [22]. In this study, we have not assessed the cost-effectiveness of this intervention, its efficiency in all clinical scenarios nor the acceptability by GDPs in a true primary care setting.

Future steps to develop this concept are to conduct a feasibility clinical study in a real setting, between a primary care provider (NHS dental practice) and a secondary care centre (Dental hospital). This should then be followed by a cluster randomised controlled trial to further assess efficacy and cost-effectiveness of the RCC in facilitating the provision of specialist dental care and referrals.

Conclusions

The combined results from the different stakeholders obtained in this proof-of-concept clinical service evaluation study, suggests that RCCs are a feasible way of delivering specialist consultations in restorative dentistry with high levels of patient acceptability and that it can be delivered in a practical and simple manner.

The outcomes of this study are very encouraging and show the true potential for the further development of the RCC concept as a modality of tele-dentistry. Significant challenges remain to be addressed, when compared to a standard in-person clinical consultation, with a focus on guaranteeing non-inferior clinical outcomes to in-person services, robustness of technology communication infrastructure, practicality of service delivery, acceptability by GDPs in primary care and the cost-effectiveness of this RCC service. Further studies are currently underway to address these points. Findings to date suggest that RCC have the potential to be translated to other fields of dentistry and medicine.

References

1 Patient Involvement and Public Accountability. A report from the NHS Future Forum (2011). Online information available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/213752/dh_127544.pdf) (Accessed August 2019)

2 Government response to the consultation 'Liberating the NHS: No decision about me, without me' Department of Health, December 2012. Online information available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/216980/Liberating-the-NHS-No-decision-about-me-without-me-Government-response.pdf (Accessed August 2019)

3 Romano D, Longson T, Martin N. Minimal Data Set for Remote Clinical Consultations in Restorative Dentistry – An exploratory case study. European Journal of Restorative Dentistry and prosthodontics, 2019. In press.

4. Greater voice for patients - The Health and Social Care Bill. NHS Future Forum Patient Involvement and Public Accountability Report 2011. Online information avalable at: http://media.dh.gov.uk/network/18/files/2011/10/B3-Greater-voice-for-patients.pdf

5- Delivering better integrated care - https://www.gov.uk/guidance/enabling-integrated-care-in-the-nhs. A policy document from Monitor, part of NHS Improvement. (March 2015)

6 Integrated care licence condition: Guidance for providers of NHS-funded service. Monitor; 2015 Publication code: IRG 08/15

7 Mills I, Frost J, Cooper C, Moles DR, and Kay E. Patient-centred care in general dental practice-a systematic review of the literature. BMC Oral Health, 2014;14: 64.

8 Loh A, Simon D, Kriston L, Harter M. Shared Decision Making in Medicine. Dtsch Arztebl 2007; 104: A-1483

9 Strasser G, Stewart DD, Wittenbaum GM. Expert roles and information exchange during discussion – the importance of knowing who knows what Journal of Experimental social psychology; 1995:31. 244-265

10 Dougall A and Fiske J. Access to special care dentistry, part 2. Communication. Br Dent Journal, 2008; 205:11.

11 Martin N, Martinez Lazalde O, Stokes CW, Romano D. An evaluation of remote communication versus face-to-face in clinical dental education. Br Dent Journal 2012; 212:277-282

12 Adlassnig, K. P. Remote diagnosis of children dental problems based on non-invasive photographs–a valid proceeding? In Medical Informatics in a United and Healthy Europe: Proceedings of MIE 2009, the XXII International Congress of the European Federation for Medical Informatics, 2009; 150:458.

13 Xiaolin L. CSCW Based Dental Clinic Image & Video Signal Processing. Applied Mechanics and Materials. 2012; 148-149: 534-7.

14 Irving M, Stewart R, Spallek H, Blinkhorn A. Using teledentistry in clinical practice, an enabler to improve access to oral health care: a qualitative systemic review. J Telemed Telecare, 2018;24:129-146

15 Braun V and Clarke V. Using Thematic Analysis in Psychology. Qualitative Research in Psychology, 2006, 3, 77-101

16 Frinton J and Chen H. Using teledentistry to improve access to dental care for the underserved. Dental Clinics, 2009;53:537-548.

17 Reddy K. Using teledentistry for providing the specialist access to rural Indians. Indian Journal of Dental Research, 2011;22:189.

18 Khemka S, Baliga S and Thosar N. Approaches to improve access to dental care services. International Dental & Medical Journal of Advanced Research, 2015;1: 1-4.

19 Commissioning Standard for Restorative Dentistry. Publishing approval number: 000214 Version number: 1.0. Prepared by: OCDO; NHS England and NHS Improvement. July 2019

20 NHS Long Term Plan v1.2. January 2019 Plan. www.longtermplan.nhs.uk. (Accessed 20 August 2019)

21 Mercer SW, Fitzpatrick B, Guthrie B, Fenwick E, Grieve E, Lawson K, Boyer N, McConnachie A, Lloyd SM, O'Brien R, Watt GC, Wyke S. The CARE Plus study - a whole-system intervention to improve quality of life of primary care patients with multimorbidity in areas of high socioeconomic deprivation: exploratory cluster randomised controlled trial and cost-utility analysis. BMC Med. 2016 22;14:88-94

22 Estai M, Kanagasingam Y, Tennant M, Bunt S. A systematic review of the research evidence for the benefits of teledentistry. J Telemed Telecare, 2018;24:147-156

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