

The capacity of the Oral Health Centre, University of Pretoria, to complete root canal treatments.

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SUMMARY

Introduction: The University of Pretoria Oral Health Centre (UPOHC) is inundated by patients presenting with toothache, many requiring emergency pulpectomies (EPs). To date, the outcome of these procedures performed at this academic/public health facility, remains unknown..

Aims and objectives: To determine the completion rate of treatment of teeth that had received EPs at the UPOHC.

Study design: A retrospective survey of data obtained from electronic and paper records of 498 randomly selected teeth from the 1050 that had undergone EPs between 1 July 2012 and 30 June 2013 at the UPOHC, followed to 30 June 2014.

Methods: The outcome of treatment was recorded as “no treatment after initial pulpectomy”, “pulpectomy repeated”, “tooth was removed” or “root canal treatment (RCT) was completed by student or dentist”.

Results: Of the 498 teeth included, 224 (44.98%) were obturated, 35 (7.03%) were retreated, forty two (8.43%) teeth were referred for extraction and 197 (39.56%) remained untreated. After 16.56 (SD 6.19) months, treatment remained incomplete in 46.58% (n=232) of cases.

Conclusions: The UPOHC lacked capacity to complete all RCTs that were started. A primary health care approach focussed on prevention combined with an integrated resource plan for oral health in the region is recommended.

INTRODUCTION

The University of Pretoria Oral Health Centre (UPOHC) is a joint initiative between the School of Dentistry of the

ACRONYMS

CCS:	Compulsory community service
EP:	Emergency pulpectomy
RCT:	Root canal treatment
UPOHC:	University of Pretoria Oral Health Centre

University of Pretoria and the Gauteng Department of Health. The institution trains dental and oral hygiene students and provides subsidised dental care to the public.

The bulk of South Africans who pursue treatment at government facilities, such as the UPOHC, are unable to pay private health fees.¹ Internal statistics from the UPOHC indicated that approximately 17 500 patients visited the facility to be screened for oral health problems during 2014. It is challenging for the staff of UPOHC to balance such a high service load with academic obligations.

In under-resourced countries, extraction is often the only option for compromised teeth because of costs or lack of qualified personnel to perform specialised treatment.^{2,3,4} The UPOHC offers an emergency pulpectomy (EP) (extirpation of the inflamed or necrotic pulp) as the preferred treatment to alleviate pain in patients who wish to retain the compromised tooth. Emergency procedures such as EPs are often squeezed in between treating other waiting patients. High patient numbers for root canal treatment (RCT) often means that a decision to retain or extract the tooth must be made quickly.⁵ Several studies have demonstrated that between 4% and 45% of patients requiring emergency dental treatment receive EPs.⁶⁻⁸ The purpose of an EP is to decrease or eradicate infected tissue and bacterial count in root canal systems, in order to prevent apical spread.⁹ Proper debridement and obturation of all canals, is necessary for the RCT to be completed.¹⁰ An incomplete RCT can result in recurring pain, which could appear about six months after the first phase of treatment.¹¹ An EP is not a long-term solution, although it is effective in the relief of pain. Despite this knowledge, however, no data exist on the time frame within which the obturation should be completed after the initial pulpectomy.³

Staff of the UPOHC render services in addition to their academic and research responsibilities and EPs are generally performed by dentists, rather than students. Patients are

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subsequently placed on a waiting list for the preparation and obturation of the affected root canals. The majority of RCTs are completed at the UPOHC by fourth and fifth-year dental students under the supervision of academic staff. Each student has to complete a minimum of five RCTs per annum. Fourth year students work on incisors, canines and premolars, while the fifth year students work on molars.¹² There are approximately 50 students in each cohort. This means roughly 500 teeth can be obturated during the academic year by the students.

There is no information on the outcome of EPs in South Africa. The only published study establishing the attendance for RCT completion following an emergency pulpectomy was from the UK.¹³ That study, conducted by Lynch *et al* at the University Dental School in Cork, Ireland, revealed that 39% of 574 patients returned for the obturation of the root canal.¹³ An extraction was performed in 11% of cases and 50% did not return for the final phase of the RCT. The authors concluded that it is necessary to correctly select patients for completion of the required RCT. They recommended that patients be advised and instructed beforehand on the importance of completing the RCT to ensure that the manpower and resources are utilized in the best possible way.¹³

Hence, it is important to measure the outcome of emergency procedures such as EPs provided in academic institutions such as the UPOHC. The aim of this study was therefore to measure the completion rate of EPs at the UPOHC and to suggest solutions for related inefficiencies in the service-rendering processes of the UPOHC.

METHODS

The University of Pretoria granted ethical approval. The manager of the UPOHC gave permission for a retrospective analysis of electronic and paper records to be conducted. The target population included patients who had undergone an EP during the period of 1 July 2012 until 30 June 2013.

The paper-based and electronic files, including radiographs on the Kodak® digital radiograph system, were accessed at the UPOHC in July 2014. Teeth that received EP during the study period were identified by procedure code: "8132" on the GoodX Dental Studio software®. These accounted for 1050 teeth of which 500 teeth were selected using computer generated randomization (Biostatistics Unit, Medical Research Council). Two of the records of the selected teeth were discarded. One record on the electronic system was a mock entry and the other was a duplicate record. The final number of teeth included for the analysis was 498.

The outcome of the pulpectomy through to 30 June 2014 was determined by studying the files and was recorded by selecting one of the categories (indicated in Table 1):

- The tooth had no further treatment after the initial pulpectomy.
- The pulpectomy was repeated but no further treatment was performed.
- The tooth was removed.
- The case was referred for extraction.
- The RCT was completed by a student.
- The RCT was completed by a dentist.

The initial pulpectomy and final treatment dates were also indicated. Thus the period for final outcome was between 12 and 24 months (1 July 2012- 30 June 2014).

Table 1: Outcome of initial pulpectomy

Categories
No further treatment was done on that tooth after the initial pulpectomy.
The pulpectomy (initial step) was repeated and no further treatment performed.
The tooth was removed.
The case was referred for tooth extraction.
The RCT was completed by a student.
The RCT was completed by a dentist.

Table 2: Frequency table for distribution of treatment procedures, performed (n=498)

Treatment Procedure	n	%
Only the initial pulpectomy performed	197	39.56
Initial pulpectomy procedure repeated	35	7.03
The specific tooth was removed/extracted	36	7.23
The specific tooth was referred for extraction	6	1.20
The root canal treatment was completed	224	44.98

Descriptive statistics were used to describe the outcome of EPs at the UPOHC. The Kaplan-Meier analysis, which provides an estimate of survival in a given length of time, was employed to describe the passage of time before which the RCTs were completed.

RESULTS

Table 2 displays the outcomes of the 498 pulpectomies which had been recorded in the sample of 498 case records examined.

In this sample, less than half (44.98%) of the teeth that were treated with EPs were completely obturated at the UPOHC (Table 2). It may be noted that of the 224 completed cases, 104 were completed by dentists, including part-time dentists appointed at the UPOHC.

Kaplan-Meier analysis revealed that 46.58% (n=232) of cases were still incomplete 16.56 months (SD 6.19) after the initial treatment.

DISCUSSION

This is the first study to report the outcome of EPs in the South African oral health care system. The resulting information provides valuable insight into capacity of the UPOHC to provide RCT to people who are dependent on Government services in the Tshwane District. These statistics are particularly relevant since the UPOHC is the sole government funded dental facility that provides RCT in the Tshwane District.

Demand versus capacity to treat - UPOHC

RCT is a very costly and time-consuming procedure in dentistry.¹ The results of this study clearly show that the demand for EPs at the UPOHC exceeds the capacity of the institution to complete the ensuing RCTs. The clinical outcomes of EPs presented in Table 2 attests to the protocol whereby the UPOHC provides EPs to non-scheduled, emergency, patients presenting with pain, without taking into account the time required for completion of the endodontic component.

The outcomes measured in this study are similar to those reported in Ireland by Lynch *et al*.¹³ The current study showed

that the RCT was completed in 45% (Table 2) of teeth that had received an emergency pulpectomy at the UPOHC. In the Irish study the completion rate was 39%.¹³ Our results show that after an average of 16.56 months, 46.5% of RCTs that were started remained incomplete. This is close to the 50% of cases that were incomplete in Lynch's study (2010).¹³ The prime reason for the uncompleted cases at the UPOHC was that patients were most probably not recalled due to the long endodontic waiting lists.

It should be noted that the UPOHC appointed a number of part-time dentists to alleviate the backlog in August 2012. These dentists completed 104 out of the total of 224 cases during the study period shown in Table 2. These results may however not be a true reflection of the UPOHC's capacity to complete RCTs. The service of some of the dentists could not be sustained due to insufficient funds. Therefore, the actual percentage of completed RCT's could have been as low as 25% had these dentists not been employed.

The extended time interval between EP and obturation at the UPOHC, as illustrated in the current study, also suggests the EP might not have been the best treatment option¹³ in the context of what the local health care system can provide. At the time of the study it was standard procedure at the UPOHC to give the patient the choice of removal or EP and placement on the waiting list. The current study shows that 7.03% of cases returned as emergencies, probably because the patient had re-occurring pain, the tooth fractured or loss of the temporary restoration (Table 2). Moreover, 8.23% of teeth that underwent EPs were eventually extracted or were referred for an extraction. It is universally accepted in dentistry that a tooth with a vital pulp should be preserved without question.²⁹ Preserving teeth through RCT in contrast to tooth loss due to extraction is an indicator that the quality of life has been improved. Every institution should aspire to offer such quality health care.³⁰ The reasons why 8.23% of teeth were removed after the EP at the UPOHC is unknown. It could be speculated that patients became disheartened with the constant pain or repetitive dental visits for the same tooth. Also, the decay within the tooth could have been very extensive causing a weakened tooth structure even prior to the pulpectomy.

Lynch *et al* suggested that one of the reasons for non-completion was that patients did not receive adequate pre-treatment counselling. The authors also suggested that teeth were poorly selected for RCT because in 10% of cases an extraction was eventually performed.¹³ Since institutional resources such as materials and salaries had been utilized to deliver those pulpectomies, a failed procedure could be considered as wasted money.¹³ Based on these findings they recommended that the quality of pre-counselling be improved to reduce such wastage.¹³ These recommendations may also be useful to improve service rendering at the UPOHC. A solution to the problem may be to correctly select patients for RCT completion and to explain to these patients how important it is to follow through with their decision to save the tooth. All feasible options should be offered to patients in an impartial way so that a well-informed decision can be made.³¹

Demand versus capacity to treat - Public Health Care System

The above-mentioned findings and the discovery that 46.58% (n=232) of cases were still incomplete 16.56 months (SD 6.19) after the initial treatment can probably be linked to the very high demand for subsidised dental care

in South Africa. The deficit in human resources in South Africa clearly does not allow the dental needs of the South African population to be adequately met.^{14,15} New dispensations in Health in 1994 granted free dental services to many at government facilities (clinics), resulting in increased demand and placing a burden on the limited existing personnel.¹⁶ Since 1994 the population of South Africa has grown considerably,¹⁷ yet, the capacity of the government dental services has remained unchanged.

The lack of capacity is further exacerbated by the escalating demands of a population beset by high unemployment rates and socio-economic inequalities. The unemployment rate in South Africa is high with nearly 13.5% of South Africans occupying informal settlements.^{17,18} The demand by patients of lower socioeconomic class for treatment at public facilities, certainly contributes to the problem of adequate delivery of oral health care in South Africa. This is particularly true of the more costly procedures such as RCT.^{4,19} In South Africa, as in other parts of the world, dentistry receives a small portion of the overall health budget and has a comparatively low ratio of 0.085 dentists per 1 000 population.^{20,21}

A proposal by the South African government to reduce the number of dentists employed and to increase the numbers of dental therapists (which to date has not been implemented), was aimed at reducing the cost of basic dental care.²² The rationale for these changes was that dental therapists, whose salary scales were lower, could perform basic restorative procedures, extractions and preventive care, allowing the dentists to deliver the more complex procedures like RCT and crown and bridge work.²¹

The South African Department of Health implemented a compulsory community service (CCS) year for dentists in 2001.²³ A report by Holtshousen on CCS dentists working in Gauteng, South Africa in 2003 found that over 80% performed mainly extractions, especially those placed in rural areas.^{16,24} Holtshousen suggested that if the dental therapists were also compelled to complete a community service year, this would release the newly qualified dentists to focus on specialized dental procedures such as RCT and crown and bridge work, thereby also improving their skills.²⁴ In the light of the long waiting list for endodontic treatment shown by the present study, another way of increasing service delivery output might be to allow these community service dentists to complete more RCTs at the UPOHC, during the periods when the rural clinics are less busy. There is most definitely a need to place a full time community service dentist at the UPOHC and possibly at other oral health teaching institutions. This placement as well as implementation of CCS for dental therapists will require capital funding by the Government into facilities, equipment and more support staff. No unfilled positions for dentists currently exist at the UPOHC and treatment chairs are restricted due to the fact that the UPOHC is primarily a training hospital.

Thus far the discussion has considered only factors related to the health care system. It is however also conceivable that factors related to the patient may also have played a role in the current predicament. Patients receiving an emergency pulpectomy often present with neglected tooth decay that extends into the pulp.²⁵ Within the South African context of joblessness and poverty, lack of resources may contribute to the delay, as transport and even phone calls to make appointments, cost money desperately needed for food. The cost of transport to the Faculty could influence

the amount of patients returning for RCT completion. Delay in seeking treatment may also be associated with anxiety linked to the perception patients have that the dental procedure is painful. This anxiety related to fear of pain is visible in the high number of patients that have poor oral health, who often only seek help when the decay has already reached the pulp or when the pain is unbearable.²⁶⁻²⁸ The identification of these factors suggest a need for an integrated primary health care approach that would be able to identify and prevent tooth decay at an early stage, reducing the need for expensive RCT.

Limitations of the study

As with many retrospective studies, the quality of the data depends on the nature of the documented records.³² The recording by dentists or students on the hospital files may have omitted some treatment procedures or the tooth number or the handwriting could be illegible. Nevertheless the record keeping was of such standard that it could be determined, with relative ease, whether a RCT was completed or not. In this regard, the digital radiographs employed in the UPOHC proved most valuable. The study period was limited to a relatively short period of two years, which may have influenced the results. Additionally, the appointment of part-time personnel on a short-term basis may have skewed the results.

The quality of completed RCTs was not considered and should also be assessed during a follow-up study to obtain a broader sense of the success of RCT provided at the UPOHC.

CONCLUSION

The evidence in this study confirms that the UPOHC lacks the capacity to complete the RCT's. An integrated primary health care strategy with a strong preventative focus should be incorporated into the National Health Insurance plan to obviate the need for expensive treatments such as RCT. It is suggested that the Government consider the expansion of oral health services in urban areas such as Tshwane as the demand for service, population growth and socio-economic disparities clearly does not correlate with the capacity to provide service.

Finally, the UPOHC should consider improving their pre-counselling protocol before providing EPs to ensure that the prognosis of a tooth is properly determined before allocation to a waiting list for further complex treatment.

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