Institution: University of Dundee
Unit of Assessment: UoA3 Allied Health Professions, Dentistry, Nursing and Pharmacy
Title of case study: The Hall Technique as a non-invasive method for managing caries in primary teeth

1. Summary of the impact

The Hall Technique offers non-invasive treatment for decayed baby teeth, sealing the decay under preformed metal crowns and thus avoiding injections and drilling. At Dundee, we brought the technique to the dental profession's attention, providing an evidence base showing: increased treatment acceptability for children, parents and dentists; improved outcomes over standard fillings; economic viability; and reduced general anaesthesia requirement. The Hall Technique is now taught and used throughout the UK, recognised Europe-wide, and increasingly adopted in Australasia and the Americas. Its inclusion in national guidelines and a Cochrane review have driven change from invasive surgical to non-invasive biological management of tooth decay in children.

2. Underpinning research

The Hall Technique for managing dental decay in children avoids injections and dental drills by placing preformed metal crowns over teeth sealing decay and stopping its progress. It has been brought into the scientific domain, investigated, refined, verified and then disseminated into wider practice as a method of caries management by the lead researchers **Evans** (Senior Lecturer, Dundee 1994-date) and **Innes** (Research Training Fellow 2000-2005, Lecturer/ Senior Lecturer, Dundee 2005-date). They have confirmed through a pilot trial and audit [i] the generalisability of the method and child/ parent/ clinician acceptance.

Our successful randomised control trial of the Hall Technique [ii] found it more effective than practitioners' conventional dental fillings at two-year follow up in preventing dental pain and infection for children. Experiences of dental treatment play a significant role in development of dental anxiety. In this split mouth designed trial, where children experienced both the Hall Technique and standard dental care, the Hall Technique was preferred over standard techniques by 95/132 children (72%), 83/132 parents (63%) and 97/132 paired events (73%) that their 17 dentists rated [ii,iii]. This has been corroborated by an audit of the Hall Technique, carried out in Sheffield [iv] involving **Innes**, which supported its high success rate and acceptance by children.

Importantly, despite the known difficulties of conducting research in primary care, this was one of the first dental trials to be successfully run in this setting. This factor was crucial to the study generalisability and translation of the research to primary care, where most child dental care is carried out. Subsequently, outcomes at five years [v] confirmed the long-term results of the Hall Technique undertaken by general practitioners being comparable to those achieved in specialist care settings with Major Failures (irreversible pulpitis, loss of vitality, abscess or tooth unrestorable) representing 2% in the Hall Technique arm and 17% for the control restorations, giving a number needed to treat of seven teeth (p=0.000004, an ARR of 0.146 [95%CI; 0.077 to 0.221]). The findings from a Cochrane review, which included the Hall Technique randomised controlled trial, have further confirmed the effectiveness of emerging biological non-invasive approaches for managing decay.

The Hall Technique is the basis for one of the three arms of a major multicentre, UK wide clinical trial - Fillings In Children's Teeth; Indicated Or Not ("FiCTION"), funded by the National Institute for Health Research, Health Technology Assessment programme, to inform best practice and future policy on provision of child dental care in the UK [vi]. It also forms one arm of another clinical trial (http://clinicaltrials.gov/ct2/show/NCT01797458?term=NCT01797458&rank=1; ClinicalTrials.gov ID NCT01797458) comparing the Hall Technique to non-restorative care and standard care. This international research collaboration between Dundee, Greifswald (Germany), the Academic Centre for Dentistry Amsterdam (the Netherlands) and Kaunas (Lithuania) investigates traditional dental

outcomes and child, parental and clinician perceptions of the technique. It addresses applicability of the Hall Technique within each country's dental system. Initial results have shown it to perform well and be acceptable to children, parents and clinicians compared to other methods for managing decay.

3. References to the research

i. **Innes** NP, Stirrups DR, **Evans** DJ, Hall N and Leggate M (2006) A Novel Technique Using Preformed Metal Crowns for Managing Carious Primary Molars in General Practice - A retrospective analysis *Brit. Dent. J.,* **200**, 451-4 & 444 (DOI:10.1038/sj.bdj.4813466).

ii. **Innes** NPT, **Evans** DJP and Stirrups DR (2007) The Hall Technique: a randomized controlled clinical trial of a novel method of managing carious primary molars in general dental practice; acceptability of the technique and outcomes at 23 months *BMC Oral Health,* **7**:18. (DOI:10.1186/1472-6831-7-18).

iii. **Innes** NPT, Marshman Z and Vendan R (2010) A Group of General Dental Practitioners' Views of Preformed Metal Crowns after Participation in the Hall Technique Clinical Trial; A Mixed-Method Evaluation. *Primary Dental Care,* **17**, 33-7 (DOI: 10.1308/135576110790307672).

iv. Gilchrist F, Howell J, Gavern D, North S, **Innes** NPT and Rodd HD (2011) Clinical outcomes for preformed metal crowns placed by dental undergraduates. *Int. J. Paediatr. Dent.,* **21** Suppl. 2, 10-15, Abstract P9 (DOI: 10.1111/j.1365-263X.2011.01167_5.x).

v. **Innes** NPT, **Evans** DJP and Stirrups DR (2011) Sealing Caries in Primary Molars; Randomized Control Trial, 5-year Results. *J. Dent. Res.,* **90**, 1405-10 (DOI: 10.1177/0022034511422064).

vi. **Innes** NPT, Clarkson JE, Speed C, Douglas GVA and Maguire A (2013) The FiCTION Dental Trial Protocol – Filling Children's Teeth: Indicated or Not? *BMC Oral Health,* **13**:25 (DOI:10.1186/1472-6831-13-25).

Competitive Research Grants

- **Innes**, NPT (Joint Principal Investigator): Hall Technique: A Priority Area: 07/44 Treatment of caries in primary teeth FiCTION - Filling Children's Teeth: Indicated Or Not?; NIHR-HTA (2008) £2,931,138 (http://www.nets.nihr.ac.uk/projects/hta/074403).
- **Innes** NPT (Collaborator): Feasibility study for an investigation into use of the Hall Technique for improving treatment outcomes with Dental Therapists in New Zealand; New Zealand Ministry of Research Science and Technology (2011) $147,826 NZ.

4. Details of the impact

Our work on the Hall Technique has, through a structured approach to assessing its effectiveness and generalisability, led to its implementation and widespread adoption. The impacts have been:

Enhancement of child dental patient experiences:

- The clinical trial of use of the Hall Technique in general practice found it to be preferred by children, parents and dentists [ii]. Its high success rate and child acceptance has been corroborated through clinical audit in Sheffield Dental School [1] and the Community Dental Service, Glasgow [2].

Adoption of the Hall Technique as best practice:

- In the wider international arena, **Evans** and **Innes** were invited to Australia (Victoria and Tasmania) in 2010, New Zealand in 2011, Holland in 2011 and 2012 and Germany in 2013, to teach the Hall Technique, and participate in discussions around its implementation in these countries. Two studies (FEAST HB in New Zealand in collaboration with Dr Foster-Page at Otago University and The Australia Hall Technique study with Professor Calache, Director, Clinical Leadership Education and Research, Dental Health Services Victoria, The Royal

Dental Hospital of Melbourne) are also investigating use of the Hall Technique in specific clinical environments prior to its adoption. Both of these studies have already generated positive initial findings and been presented at conferences.

- A pan-European study [3] found the Hall Technique to be the favoured option by half of postgraduate students for treatment of decay in a dentally-anxious child patient, evidence that it is becoming a standard treatment option for specialists.
- The Hall Technique was included as part of a national guidance document published in April 2010 [4]. This has been formally adopted in other countries including New Zealand and Poland.
- Despite development work only beginning ten years ago, the technique is taught as a standard part of the undergraduate curriculum in 15 out of 16 undergraduate Dental Schools and all 18 Dental Therapy Schools in the UK [5].
- A survey of Scottish specialists [6] found 75% were using the Hall Technique daily (45% frequently) and 65% stated that it would be their first choice of treatment for a child with significant caries.
- The E-Den Project (a joint NHS Education/tri-collegiate initiative) commissioned an online teaching module on the Hall Technique as part of its postgraduate training [7].

Improved child dental patient clinical outcomes:

- Our randomised trial showed reductions in pain and infection and reduced need for general anaesthesia extractions where the Hall Technique was used as compared to standard treatment in general practice [v].
- Preformed metal crowns use has increased in Scotland over the last 10 years, from less than 600 in 2000-1 to over 7000 in 2011-2 [8].

Supporting change in philosophy of caries management and informing debate:

- The recently updated Cochrane systematic review has included the Hall Technique in the comparison of biologically-orientated strategies (stepwise, partial and no-caries removal), with complete caries removal for managing caries in both primary and permanent teeth, concluding that there were significant advantages to less invasive strategies such as the Hall Technique [9].
- An independent commentary concluded the Hall Technique was “an effective, non-invasive treatment option … [and] … improve[d] pulpal health and patient benefit from the smaller cavity size, no need for local anaesthesia and a less traumatic procedure from the point of view of child behaviour management” [5].
- There has also been great interest in the Hall Technique internationally, with a number of overseas senior clinical teachers and public sector clinical dental directors visiting Dundee Dental School specifically to find out more about the appropriateness of adopting the Hall Technique. These have included Professor E. van Amerongen and Dr H. van Schrik (ACTA, Netherlands), Dr D. Butler (Tasmania, Australia), Dr N. Blanksmann (Nijnmegan, Netherlands), Dr D. Marshall (Hawke’s Bay, New Zealand), and Professor T. Beckmann (Minnesota, USA).
- NIHR-HTA issued a funding call (07/44/03) to investigate the impact and benefit to children of fillings compared to no fillings. However, our competitive bid for inclusion of the Hall Technique as the basis for an additional arm (http://www.nets.nihr.ac.uk/projects/hta/074403) was accepted and funded, confirming the potential of the Hall Technique as a restorative option for children. This is a multi-centre UK-wide randomised control clinical trial led by **Innes**, **Clarkson**, Douglas and colleagues [10], designed to inform national policy and teaching.

The Hall Technique has been core in informing the debate on whether the “drill and fill” approach for managing caries in permanent teeth is still appropriate. It is set to have a significant impact on the oral health of children by offering a simple method for managing caries, which is applicable in general dental practice and preferred by children compared to current methods.

5. Sources to corroborate the impact

1. Morgan AG, Gilchrist F, Cowlam J and Rodd HD (2012) Comparative outcomes for Hall vs conventionally placed preformed metal crowns. *Int. J. Paediatr. Dent.,* **22** Suppl. 2, 10-21 Abstract P29 (DOI: 10.1111/j.1365-263X.2011.01255.x).
2. McKinney A, Britton, KFM, **Innes** NPT and Cairns A (2011) The success of Hall Technique crowns on a student outreach clinic. *Int. J. Paediatr. Dent.,* **21** Suppl. 2, 8-9 Abstract PP4 (DOI: 10.1111/j.1365-263X.2011.01167_4.x).
3. Foley JI (2012) Short communication: a pan-European comparison of the management of carious primary molar teeth by postgraduates in paediatric dentistry. Eur. J. Paediatr. Dent., 13, 41-6 (DOI 10.1007/BF03262840).
4. Scottish Dental Clinical Effectiveness Programme "Prevention and management of dental caries in children". Published April 2010. http://www.sdcep.org.uk/index.aspx?o=2858.
5. Rosenblatt, A., The Hall technique is an effective treatment option for carious primary molar teeth. Evidence Based Dentistry, 2008. **9**(2): p. 44-45 (DOI: 10.1038/sj.ebd.6400579).
6. Bark JE, Dean AA and Cairns AM (2009) Opinion and usage of the "Hall Technique" amongst paediatric dental specialists in Scotland. *Int. J. Paediatr. Dent.,* **19** Suppl. 2, 9-18 Abstract P10 (DOI: 10.1111/j.1365-263X.2009.01009_5.x).
7. E-Den Project: http://www.e-lfh.org.uk/projects/dentistry/
8. ISD Scotland. *General Dental Service; Registrations and Participation Analysis*. 2000-2012. Available from: http://www.isdscotland.scot.nhs.uk/Health-Topics/Dental-Care/General-Dental-Service/dental-informatics-programme.asp?Co=Y.
9. Ricketts D, Lamont T, **Innes** NPT, Kidd E, Clarkson JE (2013) Operative caries management in adults and children. *Cochrane Database of Systematic Reviews,* 2013; Issue 3:CD003808 (DOI: 10.1002/14651858.CD003808.pub3).
10. **Innes** NPT, Clarkson JE, Speed C, Douglas GVA, Maguire A (2013) The FiCTION Dental Trial Protocol – Filling Children's Teeth: Indicated or Not? *BMC Oral Health,* **13**:25 (DOI:10.1186/1472-6831-13-25).