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What is This?
Dental Therapists: Evidence of Technical Competence

E. Phillips* and H.L. Shafer

Abstract: Dental therapists are members of the dental team in many countries, where they perform a limited number of irreversible restorative procedures. In the United States, they practice only in Alaska and Minnesota, though other states are considering adding them in an effort to improve access to care. While critics of this workforce model cite concern for patient safety, proponents argue that dental therapists provide treatment that is as technically competent as that provided by dentists. Though nearly 2 dozen studies from industrialized countries address this subject, this article systematically reviews all 23 of them. Of these reports, all but 2 conclude that dental therapists perform at an acceptable level. Every study that directly compared the work of dental therapists with that of dentists found that they performed at least as well. Regardless of whether dental therapists would be the most effective intervention for improving access to oral health care in the United States, the evidence clearly suggests dental therapists are clinically competent to safely perform the limited set of procedures that falls within their scope of practice.

Key Words: mid-level provider, quality of care, review, access to care, restorative, auxiliaries.

Dental therapists are members of a workforce model that, while not common in the United States, is widely used internationally. Sometimes compared with physician assistants or nurse practitioners, dental therapists perform a limited set of restorative procedures under the supervision of a dentist. A primary goal of this workforce model is to improve access to care by reducing costs and increasing the number of providers.

In the United States, dental therapists practice only on Alaskan tribal lands and in Minnesota, though interest is increasing elsewhere. Rarely a week goes by without a reference to dental therapists somewhere in the national press, and their possible widespread introduction into the American workforce is evoking heated debate. The American Dental Association and most state dental associations oppose the concept, citing concern for patient safety and viability in the U.S. market (ADA, 2005, 2011). In contrast, several other groups, such as the American Association of Public Health Dentistry, the Kellogg Foundation, and the Pew Charitable Trusts, maintain that therapists provide safe and affordable care and have expressed interest in adding them to the U.S. dental team. Legislators at the Federal level and in many states have also expressed interest.

While there appears to be little concern internationally, a primary area of contention in the United States is the safety of the care provided by therapists. In fact, therapists’ ability to provide safe, quality care has been a topic of reports dating to the early 1950s, though the results of the totality of these studies have never been presented in a single targeted review. A recent Kellogg report, A Review of the Global Literature on Dental Therapists, prepared by Nash et al. (2012), is extensive, touching on topics well beyond technical competence, but the format makes analyzing and comparing studies nearly impossible. Thus, with the goal of providing a valuable resource as this workforce model continues to be explored in the United States, the current review identifies and reviews every English-language study from an industrialized country that assesses the clinical competence of non-dentists performing irreversible restorative procedures.

Twenty-three studies have addressed this issue, as either a primary or secondary point of interest. While the large variation in methodology, as well as a lack of details in some, precluded a formal meta-analysis (effect sizes cannot be standardized), a systematic framework was developed to assess these reports. A series of tables lays out, in a concise and comparable fashion, each study’s methods, sample, procedures evaluated, and findings with respect to competence. While a longer review article, including this full, detailed set of tables, can be found in the Appendix to this essay, a summary of key findings is presented here.
The Table lists the 23 studies included in the review. The earliest are predominantly observational reports based on fact-finding missions to New Zealand, where, in 1921, dental therapists were first introduced. The majority of the studies, however, are empirical, and of these, 5 are true experiments. Studies are discussed by type: observational reports first, then the experiments, and then other empirical reports.

The earliest findings come from 3 visits to New Zealand in the early 1950s. Two additional fact-finding trips (one of which also included stops in Australia) were conducted in the early 1970s. In each case, the authors interviewed key informants and visited schools, clinics, and/or training facilities. The reports issued by Braddock et al. (1951) and Dunning (1972) are entirely impressionistic. In fact, in neither case did the authors attempt to evaluate any work first-hand. Both, however, came away with positive impressions of the work being done by dental nurses (as therapists were then known) in the School Dental Service (SDS). Indeed, according to Braddock et al., “the dentists we met were in arms at any suggestion of clinical shortcomings which we deliberately suggested to test opinion.” The other 3 observational reports, while having empirical elements, do not provide truly rigorous evaluations of technical competence. Though in each case the authors observed restorations in children, the judging criteria tended to be subjective and/or were not fully reported. Both Fulton (1951) and Friedman (1972) concluded that the quality of the work performed by school dental nurses was high. Friedman stated that “having seen the product first hand, I can attest to the adequacy of training.” He also maintained that, based on a review of x-rays, he was unable to tell the difference between restorations placed by nurses and those placed by dentists.

A report by Gruebbel (1950), while ostensibly empirical, contains sufficient shortcomings, not to mention clear biases, that it must be considered observational. Gruebbel judged the amalgam restorations placed by school dental nurses to be “mediocre”. In fact, he found nearly 30% to be defective. He appears, however, to have assumed that all of the restorations he examined were placed by nurses, though there is reason to believe that a large number had actually been placed by dentists (Saunders, 1951). Gruebbel also remarked repeatedly on the negative implications of New Zealand’s “socialist” system for both society and the dental profession. And, in direct contrast to the contemporaneous reports of Fulton and Bradlaw et al., Gruebbel stated that “a large number of dentists” had concerns about the SDS. This observation was vehemently disputed by the Director of Dental Hygiene (Saunders, 1951).

While our ability to draw firm implications from the preceding studies may be weak, randomized controlled experiments provide more convincing evidence on the effectiveness of a given treatment. Five studies from the 1970s, 4 conducted in the United States and one in the Netherlands, were designed this way. Each tested whether dental hygienists could be taught to prepare and place restorations as well as dentists. The study conducted in the Netherlands is the hardest to assess, since the only English-language article discussing it focused on examiner variability in assessing the quality of restorations, rather than on the quality of the restorations, per se. The data used, however, came from a study in which hygienists were trained to prepare and restore adults’ teeth; their work was compared with that of both dental students and private practice dentists. Based on the data reported, the hygienists appeared to have performed at least as well as the dental students, and perhaps better than the dentists (Swallow et al., 1978).

At around the same time, 3 U.S. universities (Howard, Iowa, and Kentucky), as well the Forsyth Dental Center in Massachusetts, began pilot programs to train dental hygiene students (or, in the case of Forsyth, recently graduated hygienists with some practice experience) to prepare and place restorations. Their work was compared with that of dental students, or, in the case of Forsyth, with that of practicing dentists. All of the pilots had dentists pre-screen patients who were then randomly assigned to a practitioner; all used outside examiners to conduct blind evaluations, according to specific, set criteria. All 4 concluded that hygienists performed as well as dentists (Powell et al., 1974; Spohn et al., 1976; Sisty et al., 1978; Lobene, 1979). Nearly every individual comparison resulted in no qualitative difference between the two practitioner groups; in those few instances when statistically significant differences were observed, they were small in absolute terms, with no consistency as to which group was superior. These studies had relatively small sample sizes, but taken together they provide strong evidence that hygienists can, in a relatively short period of time, be trained to provide such irreversible procedures as Class I, II, and III restorations at a level that is comparable with that of dentists.

[Classes I, II, and III refer to the specific teeth and surfaces being restored (i.e., a Class II restoration is on proximal surfaces of molars or premolars).]

Of the 13 other empirical studies, 3 were early evaluations of the Alaskan Dental Health Aide Therapist (DHAT) program; 3 were conducted in Canada, where therapists practice in remote tribal areas, and in the 1970s, Saskatchewan established a short-lived school-based system; 3 studies were conducted in Australia, where therapists have practiced, with state variation, since the 1960s; 2 were conducted in the United Kingdom, where therapists have also been practicing to various degrees for some time; and the last was the result of another U.S. fact-finding trip to New Zealand. Taken as a whole, this body of work, like the set of experiments conducted in the 1970s, provides strong evidence of the ability of dental therapists, working in several settings and systems, to prepare and place restorations at an acceptable level—indeed, at a level that is at least comparable with that of dentists working in the same settings. In fact, of these reports, only one drew negative conclusions. At the behest of the (then) 2 California dental associations, a team went to New Zealand in the early 1970s to gather information, since, at the time, California was considering a school-
Table.

Report or Study Discussing the Technical Quality of Care Provided by Non-dentists Preparing and Placing Restorations

<table>
<thead>
<tr>
<th>Author</th>
<th>Date</th>
<th>Country</th>
<th>Type of Study</th>
<th>Overall Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gruebbel</td>
<td>1950</td>
<td>New Zealand</td>
<td>Observational</td>
<td>Critical of the program based on the high incidence of caries, the nurses’ training, their quality of work, and the “socialist” nature of the system.</td>
</tr>
<tr>
<td>Bradlaw et al.</td>
<td>1951</td>
<td>New Zealand</td>
<td>Observational</td>
<td>New Zealand nurses exhibit a high standard of technical efficiency in the treatment of children.</td>
</tr>
<tr>
<td>Fulton</td>
<td>1951</td>
<td>New Zealand</td>
<td>Observational</td>
<td>New Zealand dental nurses are capable of producing amalgam restorations of high quality.</td>
</tr>
<tr>
<td>General Dental Council</td>
<td>1966</td>
<td>United Kingdom</td>
<td>Empirical</td>
<td>Dental auxiliaries are well-trained to carry out simple amalgam restorations; the quality of clinical work is high.</td>
</tr>
<tr>
<td>Dunning</td>
<td>1972</td>
<td>Australia, New Zealand</td>
<td>Observational</td>
<td>General impressions were that the quality of work in both countries was good.</td>
</tr>
<tr>
<td>Friedman</td>
<td>1972</td>
<td>New Zealand</td>
<td>Observational</td>
<td>Found the technical quality of treatment to be quite high.</td>
</tr>
<tr>
<td>Redig et al.</td>
<td>1973</td>
<td>New Zealand</td>
<td>Empirical</td>
<td>A New Zealand-type dental nurse would not be acceptable to Californians.</td>
</tr>
<tr>
<td>Roder</td>
<td>1973; 1976</td>
<td>Australia</td>
<td>Empirical</td>
<td>The quality of restorations placed by the school dental service was good.</td>
</tr>
<tr>
<td>Powell et al.</td>
<td>1974</td>
<td>United States</td>
<td>Experimental</td>
<td>If the samples of dental therapist trainees and junior dental students are representative, there is no difference in their performance on the procedures evaluated.</td>
</tr>
<tr>
<td>Spohn et al.</td>
<td>1976</td>
<td>United States</td>
<td>Experimental</td>
<td>Dental hygienists performed at a level comparable with that of senior dental students for specific procedures.</td>
</tr>
<tr>
<td>Ambrose et al.</td>
<td>1976</td>
<td>Canada</td>
<td>Empirical</td>
<td>The quality of services was at a generally high level.</td>
</tr>
<tr>
<td>Sisty et al.</td>
<td>1978</td>
<td>United States</td>
<td>Experimental</td>
<td>The dental hygiene students were able to perform selected operative and periodontal procedures at a level comparable with that of senior dental students.</td>
</tr>
<tr>
<td>Swallow et al.</td>
<td>1978</td>
<td>Netherlands</td>
<td>Experimental</td>
<td>No specific conclusions reported with regard to technical competence (it was not the main focus of the study).</td>
</tr>
<tr>
<td>Lobene</td>
<td>1979</td>
<td>United States</td>
<td>Experimental</td>
<td>The services provided by expanded-function dental hygienists can be of high quality.</td>
</tr>
<tr>
<td>Jones et al.</td>
<td>1981</td>
<td>United Kingdom</td>
<td>Empirical</td>
<td>No specific conclusions reported with regard to technical competence (it was not the main focus of the study).</td>
</tr>
<tr>
<td>Lewis</td>
<td>1981</td>
<td>Canada</td>
<td>Empirical</td>
<td>The economies of scale in terms of cost per child were not accomplished at the expense of lower quality.</td>
</tr>
<tr>
<td>Barmes</td>
<td>1983</td>
<td>Australia</td>
<td>Empirical</td>
<td>The data do not support the charges of inferior quality in the SDS. The quality of care that has been provided by the SDS can only be described as excellent, both clinically and in the social sense.</td>
</tr>
<tr>
<td>Crawford &amp; Holmes</td>
<td>1989</td>
<td>Canada</td>
<td>Empirical</td>
<td>Therapists play a very important role, and should be expanded, rather than replaced by contract dentists.</td>
</tr>
<tr>
<td>Bolin</td>
<td>2008</td>
<td>United States</td>
<td>Empirical</td>
<td>No significant evidence was found to indicate that irreversible dental treatment provided by DHATs differed from similar treatment provided by dentists.</td>
</tr>
<tr>
<td>Calache et al.</td>
<td>2009</td>
<td>Australia</td>
<td>Empirical</td>
<td>The standard of restorations provided by dental therapists newly trained to provide care to adults was at least similar to that expected of newly graduated dentists.</td>
</tr>
<tr>
<td>Bader et al.</td>
<td>2011</td>
<td>United States</td>
<td>Empirical</td>
<td>DHATs are performing at what must be considered an acceptable level.</td>
</tr>
</tbody>
</table>

a These same data were also analyzed by Trueblood (undated).

b These same data were also reported in Wetterhall et al. (2010).
based program. The team examined a “representative” number of children, and while overall just 7% of restorations were judged unsatisfactory, they nevertheless concluded that “[t]he attempt to solve the weaknesses in the California public and private dental care systems by establishing a New Zealand dental nurse type of technician is unwarranted” (Redig et al., 1975).

Though quite different methodologically, all but 2 of the 13 non-experimental empirical studies involved direct clinical evaluations; the 2 that did not (Lewis, 1981; Bolin, 2008) relied on chart reviews. In these 2 cases, as well as in a chart review conducted by Bader et al. (2011), random or quasi-random samples of therapists’ patients’ charts were examined for either post-procedure complications or failed restorations. In all cases, the rates of these problems were very low (less than 3%), and in the one study that directly compared therapists’ complication rates with those of their supervising dentists, no significant difference was found (Bolin, 2008).

Half of the studies that involved clinical examinations also used control groups, and in most cases blinded examinations were performed. Three of these studies took place in South Australia, where children served by the SDS (the vast majority of whose restorations would have been placed by therapists) were compared with non-participants (all of whose restorations were placed by dentists). The restorations in SDS children were judged either to be no different from those in non-participants (Roder, 1976) or to be somewhat superior (Roder, 1973; Barnes, 1983). In Canada, Ambrose et al. (1976) compared restorations in children treated by the Saskatchewan Dental Plan (which employed therapists) with those performed by dentists, and Crawford and Holmes (1989) compared restorations in both children and adults in Baffin Island, some of whom had been treated by therapists, and some by dental residents or dentists. In both cases, the work of therapists was judged, overall, to be superior to that of dentists, though Ambrose et al. found no significant differences with respect to stainless steel crowns. Finally, Bader et al. (2011) compared the work of Alaskan DHATs with that of their supervising dentists and found that, on 2 of 3 measures, the DHATs outperformed the dentists.

The remainder of the studies involved evaluating the work of practicing therapists. Fiset (2005) performed the first evaluation of Alaskan DHATs. While he did not report figures, he stated that all of the cavity preparations and restorations he observed “met the standard of care” established. Three other studies are more rigorous. Calache et al. (2009) evaluated the work of therapists treating adults in New South Wales, Australia, and Jones et al. (1981) and The General Dental Council (1966) evaluated the work of therapists treating children in the United Kingdom. Though samples in the first 2 were small, in all 3 studies, examinations were conducted post-treatment, and in all cases less than 10% of the procedures evaluated were judged to be unsatisfactory (just 5.4%, 2.5%, and 9.2%, respectively). According to all 3, this indicated an acceptable level of work.

It is perhaps worth noting that of the nearly 2 dozen studies reviewed, all but 4 (3 of which evaluated the new Alaska DHAT program) were conducted over 20 years ago. This is largely a result of a consensus outside of the United States with regard to the clinical competence of dental therapists (e.g., Jones et al., 1981). The current review supports this conclusion. Of the 23 reports addressing the technical competence of dental therapists (or specially trained hygienists) performing irreversible dental procedures, all but 2 concluded that dental therapists performed the procedures assessed at an acceptable level. And all that directly compared their work with that of dentists or dental students found that they performed at least as well. Of the 2 studies drawing negative conclusions, one (Gruebbel, 1950) exhibited clear methodological shortcomings and biases. The other (Redig et al., 1973), a more careful study, actually found that the New Zealand school dental nurses performed rather well, but nevertheless concluded that a similar program would not be suitable for California.

Rarely in the scientific literature, in fact, do we find such an overwhelming consensus based on empirical research. The fact that methodologies differ, and the studies span such a long time period and come from several countries, can only increase confidence in the conclusion that, rather than representing a different standard of care, dental therapists simply represent a different provider.

This review does not speak to the expected impact on access that the introduction of this provider model might have or its economic viability in the United States. However, it is clear that therapists’ ability to safely and competently perform the limited set of irreversible procedures that fall within their scope of practice is no longer a point of contention, at least from an empirical standpoint. Given this, and given the strong support among various governmental and non-profit entities for introducing dental therapists to the U.S. workforce, future research efforts might be better focused on the economic feasibility/sustainability of this model within the U.S. context, the acceptability of these types of providers to the American public, and the impact such providers might have on access to care.

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