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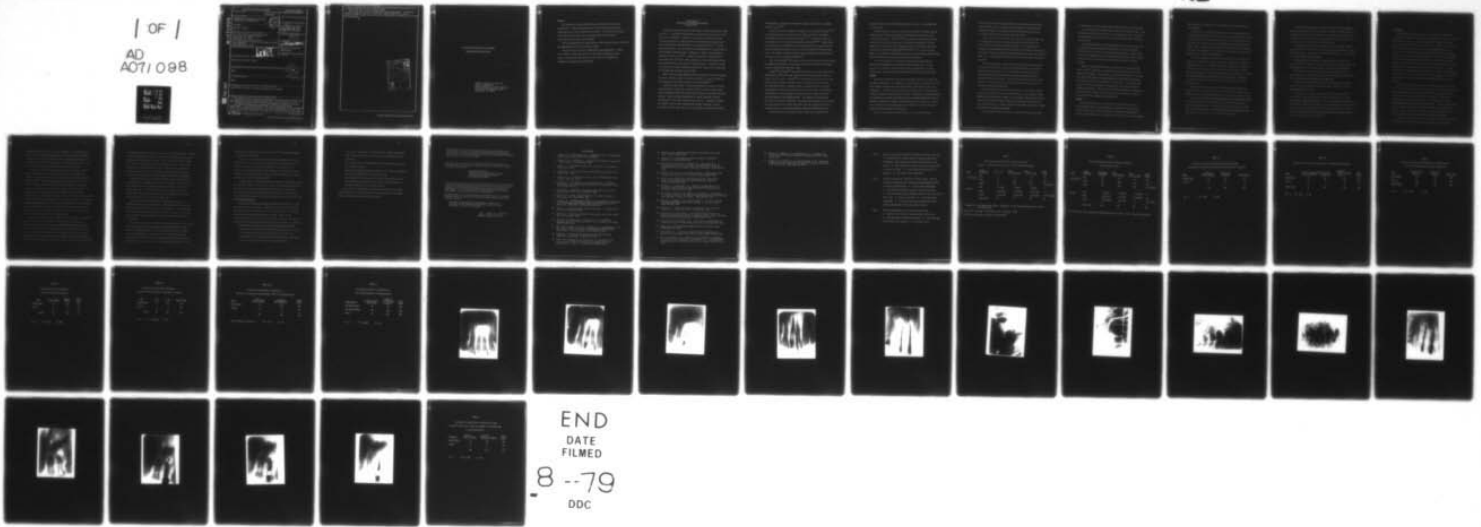
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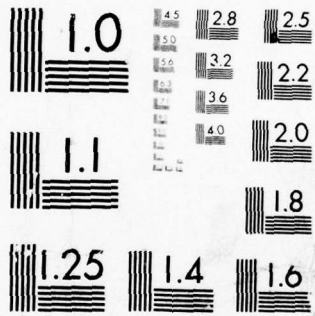
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→ The one-appointment not trephined had a 16% incidence of pain while the two-appointment had a 9.6% incidence of pain.

Sixty-nine of 70 cases of trephination were asymptomatic. Statistical analysis showed the increase in pain when trephination wasn't used was significant (98% level), yet its value as a prophylactic procedure was discussed and questioned.

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EVALUATION OF PROPHYLACTIC ALVEOLAR  
TREPHINATION: TO AVOID PAIN

Donald D. Peters, BA, DDS, MS  
Mentor, Endodontics  
US Army Institute of Dental Research  
Walter Reed Army Medical Center  
Washington, DC 20012

## ABSTRACT

Two hundred and twenty-five teeth were filled after one or two appointments. Fifty one-appointment fills were trephined and 50 not trephined, unless they experienced severe pain. One hundred and twenty-five teeth were filled at the second appointment and only those experiencing severe pain were trephined.

The one-appointment not trephined had a 16% incidence of pain while the two-appointment had a 9.6% incidence of pain.

Sixty-nine of 70 cases of trephination were asymptomatic. Statistical analysis showed the increase in pain when trephination wasn't used was significant (98% level), yet its value as a prophylactic procedure was discussed and questioned.

EVALUATION OF  
PROPHYLACTIC ALVEOLAR TREPHINATION:  
TO AVOID PAIN

Artificial fistulae have been discovered in skulls dating from 2,900 years B.C. In the Western Hemisphere trephination dates back at least to the Inca civilization.<sup>1</sup> However, in dentistry trephination has been reserved basically for those cases of excruciating unrecalcitrant pain due to acute apical periodontitis or acute apical abscess.<sup>1,2</sup> It has been advocated for cases of active pus formation when it is impossible to get drainage through the canal. Generally, a basic I & D procedure is suggested in these cases.<sup>2,3</sup> Luebke<sup>4</sup> has advocated trephination for acute infectious "flare-up" after completion of root canal treatment but has pointed out that this occurrence should be rare. Weine<sup>3</sup> has stated it may be used in acute situations where dowel crowns make it impossible to alleviate the situation via the canal.

Many clinicians have seemed to avoid trephination if at all possible. They have, instead, tended to rely on antibiotics, powerful analgesics, and leaving the tooth open to try to solve the problem.<sup>5-7</sup>

Ingle<sup>1</sup> has stated that, "to allow the patient to remain in violent uncontrolled pain borders on criminal neglect", and that "trephination where indicated and done well gives great relief to a terribly suffering patient." More recently trephination or "apical aeration" has been advocated for a far wider range of cases such as: treatment of gangrenous teeth in one session; beginning of abscess formation; chronic secretion from the root canal; cystic granulomae; and cases of overfill.

Unfortunately, no data was presented to support the claims for a higher rate of success.<sup>8-10</sup>

One of the basic principles in healing is to establish drainage.<sup>11,12</sup> Investigators have even, in the face of acute cellulitis, advocated extraction in order to establish drainage.<sup>13,14</sup> Leaving the tooth open for drainage is a fairly common endodontic procedure.<sup>3,5,11</sup> Trephination to the source of an infectious process would appear to be a more certain means of obtaining drainage, and so remove any reason for leaving canals open. This should eliminate further canal contamination and decrease the necessity of more numerous appointments.<sup>12</sup>

Dorn and associates<sup>15</sup> do show an increase in the use of artifistulation by endodontic diplomates in cases where swelling is present and drainage cannot be obtained via the root canals.

Bhaskar<sup>16</sup> and Bender<sup>17</sup> have published theories as to why they believe perforation via the root canal into the apical lesion should lead to a higher rate of success. Bhaskar<sup>16</sup> has stated that instrumenting 1 mm past the apex two or three times with a small file will lead to hemorrhage and inflammation with a resultant local or generalized destruction of the epithelial lining and resolution of the apical lesion. Bender<sup>17</sup> has stated that it is the decrease in internal pressure within the apical cyst that leads to the healing process. He advocated penetration at least to the center of the lesion. Therefore, both authors have indicated that the placement of a small instrument into the radiolucent area is a valid procedure in stimulating healing, albeit for different reasons.

Both these authors and others such as Block and associates<sup>18</sup> do

point out that this overinstrumentation via the canal can possibly lead to severe pain.

Healing appears to occur in most cases of apical rarefaction due to pulpal disease without perforation of the lesion via the canal or by alveolar trephination. Most<sup>1,16-26</sup> also agree that a high proportion of apical cysts can heal if the tooth is treated nonsurgically. But the significance of how much of an increase could be expected by overinstrumentation as advocated by Bhaskar<sup>16</sup> and Bender<sup>17</sup> needs to be answered. Also, can an alveolar trephination procedure increase healing significantly while avoiding the pain mentioned by both investigators?

It is the purpose of this paper to determine statistically how effective trephination is in preventing and relieving pain. In the future, it is hoped to answer whether alveolar trephination increases the chance of success over just penetration of the lesion via the canal.

#### METHOD

Group one consisted of 100 cases presenting radiographic evidence of an apical rarefaction. To equalize as many variables as possible all cases were opened, instrumented, and filled by this investigator at the first appointment. Standard aseptic endodontic principles were followed using a lateral condensation gutta-percha technique. Regardless of symptoms present or location of the tooth every other case was trephined making 50 cases of alveolar trephination, Group I-A, and 50 control cases, Group I-B. In each of the control cases an attempt was made to place a small instrument at least out into the center of the lesion.

In the trephination procedure the area was anesthetized and a

vertical stab incision using a Bard-Parker #15 blade was made in the loose alveolar mucosa. Care was taken to place the incision either slightly mesially or distally of the root of the tooth in question, to avoid penetration of a bur over the root itself.

After the soft tissue incision was made, an attempt was made with the endodontic explorer to locate any possible penetration of the cortical plate created by the apical lesion. If a penetration was located, a new #35 Hedstrom file was placed into the defect and penetration of the lesion was continued until resistance of a bony nature was met (Fig. 1). A radiograph was made in each case to confirm the instrument placement.

If no defect of the cortical plate was located, the tissues were retracted and the cortical plate was penetrated using a #4 round bur in the slow speed handpiece. In cases where the anatomy permitted it and the region of the lesion was certain, penetration directly into the lesion was performed. If there was any question of the exact location of the lesion, the area with the greatest distance between roots was chosen for penetration.

Once penetration of the cortical plate was accomplished a new #35 Hedstrom file was placed to the area of the apex and a radiograph taken. Before the instrument was removed, it was worked in and out two or three times to assure that drainage of the lesion would be accomplished and that also any cystic sac would certainly be disrupted and some hemorrhage into the lesion would be stimulated.

In multicrooted teeth an attempt was made to enter only the larger

of any lesions present, and an I-drain placed into the area (Fig. II).

Each patient was contacted the next day for a progress report. The patients were told to use aspirin or acetaminophen if they experienced any discomfort, and to report any evidence of pain any time following the procedure.

Any control patients reporting pain which they felt the aspirin or acetaminophen was inadequate in controlling, or claiming that the pain kept them awake were listed as having severe pain. Each of these cases was immediately seen and trephined to evaluate its effect in pain relief and the case placed in the trephination category to follow healing.

Group II consisted of 125 cases opened on an emergency basis by other dentists, medicated, temporary fillings placed and referred for endodontic treatment. These teeth were then all treated by instrumentation and filling when first seen except here only those experiencing pain following fill were trephined. This allowed a comparison of the incidence of pain following a one-appointment and a two-appointment endodontic procedure. There was a wide variation in the two-appointment group in how the original emergency procedure was handled in relation to intracanal instrumentation and medication.

## RESULTS

A summary of the basic results may be seen in Tables I and II. In the group of 50 cases of prophylactic trephination, there were no cases of severe pain. While most patients reported an almost total lack of postoperative pain, some did report a few hours of mild discomfort.

Most reported that they felt it unnecessary to take any aspirin or acetaminophen.

Of the control group of 50 cases, there were eight patients who reported pain which was considered to be in the severe category, where they felt that the aspirin or acetaminophen was inadequate to control their pain or reported that the pain had kept them awake during the night. After trephination, all patients were relieved of pain by the time the anesthesia wore off. Avoidances of pain by trephination was significant at a 99% level (Table III).

In the two-appointment fills of the twelve cases of severe pain which were trephined one patient reported a continuation of pain the following day. On re-evaluation of the case, which was a mandibular left first molar, adequacy of the trephination procedure had to be questioned, since on retrephining there was some difficulty in locating an area of complete penetration of the cortical plate. Following retrephination, the patient had no more discomfort except for the tissue soreness.

Tables IV and V show that there is a 98% probability that the trephination was the significant factor in whether the patient did or did not have severe pain following either a one or two-appointment fill.

In some cases following trephination there was a very slight edema in the area, but in no case did this seem to be excessive for the procedure involved, and as indicated trephination relieved or avoided pain in 69 of 70 patients. In no trephined case did the patient run a high fever or give signs of an acute infectious process.

Teeth that had any sealer or gutta-percha past the radiographic apex were placed in the overextended fill category. In both Group I-A and Group II there was a much higher percentage of pain in the overextended cases (27.3% and 20.7%, respectively, Tables I and II). This was significant at over a 98.8% level (Table VI).

In both Groups I-A and II the incidence of pain whether filled less than 1 mm or more than 1 mm short was very close (12.5% vs. 13.6%, Group I-A, Table I, and 6.3% vs. 6.3% Group II, Table II). Statistically it was not significant (Table VII).

Although there was a greater incidence of pain following one-appointment (16% Table I) vs. two-appointment procedures (9.6% Table II) the difference was significant only at the 77% level (Table VIII).

The incidence of canals being overextended following a one-appointment or two-appointment procedure was checked and found to have less than a 5% chance of significance (Table IX).

Also in this study the incidence of pain related very poorly to whether the tooth filled was anterior (central-cuspid) or posterior (bicuspid-molar) (Table X).

An attempt was made to maintain all instrumentation within the canal in the cases to be trephined, while in the controls, a small instrument was taken past the apex. Yet, there were the same number of overfills, eleven in the fifty cases of trephination, and eleven in the fifty cases of instrumentation past the apex. Therefore in relation to overextension of fill material, instrumentation out the apex with a size 10 instrument was not significant.

## DISCUSSION

Trephination done properly appears successful in relieving or avoiding severe pain in cases where an apical lesion is present. This would at first appear to support the position<sup>8,9</sup> that trephination should be used in a much wider range of cases. However, most studies indicate that the incidence of severe pain following fill in the presence of an apical lesion is quite small.<sup>27-30</sup> In this study the incidence of severe pain was somewhat higher; 16.0% in the one-appointment fill control group and 9.6% in the two-appointment fill group. Taking even the highest statistical figures, the clinician must trephine 100 patients to insure that only 16 do not have any pain. It would seem that a more rational approach would be to reserve the trephination procedure for those cases where pain does occur, unless, in the future a significant increase in apical healing following trephination can be shown.

If a dentist is going to trephine prophylactically just to avoid pain, it appears that the best procedure would be, immediately following fill, to trephine only those cases of overfill since they had by far the highest incidence of severe pain. According to this study, in one-appointment fill cases only four cases of overfill would have been trephined to avoid one case of severe pain. In the two-appointment fill cases only five cases of overfill would have been trephined to avoid one case of severe pain. Also, following trephination excess sealer could be irrigated and curetted from the area (Fig. 3).

If 70-90% of apical lesions heal following nonsurgical endodontics,<sup>5,20,21,24</sup> it is questionable whether all apical lesions should be

trephined to increase the success rate slightly. Cases which do not heal over an extended period probably need retreatment or exploratory surgery to rule out other problems such as inadequate obturation or a vertical root fracture. It does appear trephination has a use in some cases of pain and swelling instead of just relying on drugs.

Another advantage of trephining in the acute infectious state is that it eliminates the necessity of opening the apical foramen to establish drainage and thus increasing the chance of overextending the apical filling.<sup>1</sup> While in this study overextension did not seem to increase with use of an instrument past the radiographic apex, only a very fine instrument, size 10, was purposely used to overinstrument. The majority of overextensions in this study appeared to be only slight amounts of sealer past the apex. The equal number of overextensions in all categories likely relates to a consistent procedure in conjunction with equalizing variations in distances between the true and radiographic apex, rather than the overinstrumentation with the size 10 instrument. If any canal of a multirooted tooth was overextended, it was placed in the overextended category for the study of pain.

The incidence of pain appears high in relation to other studies,<sup>27-30</sup> although taken together overall incidence of pain related best to Soltanoff's findings.<sup>28</sup> Fox and associates<sup>29</sup> found only 6.0% moderate to severe pain following one-appointment fills where there was a lesion present. Perhaps the 16% following one-appointment fills here relates to the fact that in all of these cases an attempt was made to slightly overinstrument the apical lesions with a small instrument. Both Bhaskar<sup>16</sup>

and Bender<sup>17</sup> point out that this does increase incidence of pain. Perhaps another control with no overinstrumentation of the apical lesion in the nontrephined category was indicated. In the second part of the study where this was done, the incidence of pain did decrease. Other possibilities for the high incidence of severe pain could relate to the small sample, 50, or even an investigator tendency to place the pain cases into the more severe category to allow trephination evaluation.

Unlike the Seltzer and associates<sup>30</sup> study, little variation was found between the incidence of pain in cases filled to within 1 mm. of the radiographic apex and filling slightly more than 1 mm. from the radiographic apex. This may relate to the fact that here very few canals were filled more than 1.5 mm. from the radiographic apex, and none more than 2.5 mm. from the radiograph apex.

In the face of long term failure, it must be questioned if trephination is the treatment of choice. Retreatment via the canal or exploratory full flap surgery may be more appropriate. These hopefully can rule out possible causes of failure such as inadequate obturation, fractured roots, unfilled canals, systemic disease, tumors, or other possibilities.

No area of the mouth was considered inaccessible, but if trephination is to be used, great care must always be exercised to avoid anatomy such as the maxillary sinus, nasal cavity, mental foramen, mandibular canal and especially the roots of the teeth! In this study making judicious use of the x-rays and careful alignment and placement of the instruments, there were no cases showing radiographic evidence of root

perforation as shown by Serene and associates.<sup>31</sup> But this possibility must always be considered!

In the use of trephination, it should be pointed out that in this study it became more and more a tendency to move the incision closer to the apex and trephine almost directly over the apical lesion whenever the anatomy allowed. Another future area of study could be whether or not irrigation and curettement after trephination of apical lesions may increase healing potential.

In this study a vertical rather than horizontal or semilunar incision was used which follows the direction tension is placed upon this tissue. This appears to allow healing with minimal scarring. The incision was kept away from the attached gingiva to avoid any possible chance of a dehiscence forming from the attached gingiva to the area of incision.

#### SUMMARY AND CONCLUSION

A clinical investigation into the ability of trephination to avoid and relieve pain was conducted. Patients were divided into two groups with their teeth being filled in one or two-appointments. Every other case in the one-appointment group was trephined. Any case not trephined which then experienced severe pain was trephined. In the two-appointment fills only the teeth experiencing severe pain were trephined.

From statistical analysis the following conclusions were made.

- Trephination into an apical lesion both avoids and relieves pain.
- The incidence of severe pain following either a one or two-appointment fill is low enough to make a practice of trephining all apical lesions on filling of questionable value.

- In cases of severe pain, trephination allows rapid resolution of signs and symptoms with less reliance on strong analgesics and antibiotics.
- Overextension of the filling material did significantly increase the incidence of pain.
- Whether the canal was filled more than or less than one millimeter short was not significant in relation to pain.
- The incidence of pain whether the canal was filled after one or two appointments or whether an anterior or posterior tooth was not highly significant in relation to pain.

In conclusion, prophylactic trephination of all teeth with apical lesions appears to be unsound treatment, but trephination is probably an underrated and underused procedure of value.

"The informed consent of all human subjects who participated in the experimental investigation reported or described in this manuscript were obtained after the nature of the procedures and possible discomforts and risks had been fully explained."

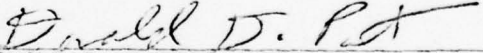
Dr. Peters is a mentor for the Endodontic Residency Program of the United States Army Institute of Dental Research. Request for reprints should be addressed to:

LTC Donald D. Peters  
US Army Institute of Dental Research  
Walter Reed Army Medical Center  
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DONALD D. PETERS, LTC, DC

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FIG 1 Patient referred in pain with swelling of mandibular anterior. A. Mandibular left central did not respond to pulp tests. Mandibular right central and laterals tested within normal limits. B. Left mandibular central received one-appointment root canal filling. C. Lesion being trephined with #35 Hedstrom. D. Six-month recall radiograph.

FIG 2 Patient reported with toothache maxillary right. Teeth #7 and #8 no response to pulp testing and radiographically have associated radiolucencies. A. Teeth filled immediately. B. Trephination performed and drain ready for placement. C. Drain placement using periodontal probe to insert one end in the lesion. D. Drain in position. E. Six-month recall radiograph. F. Six-month photograph showing white dot of fibrous attachments in the area of the incision.

FIG 3 Patient asymptomatic but lesion noted on panorex. A. Maxillary left lateral with associated radiolucency. B. One-appointment filling overextended. C. Area following trephination and irrigation. D. Six-month recall.

TABLE I

## Pain Following Root Canal Treatment in Group I.\*

Group I - A One Appointment Fill. - Not Trephined (Control).

| <u>Pain</u> | <u>Tooth Position**</u> | <u>Fill Overs Extended</u> | <u>Fill &lt;1 mm to Apex</u> | <u>Fill &gt;1 mm to Apex</u> | <u>Total Cases</u>  |
|-------------|-------------------------|----------------------------|------------------------------|------------------------------|---------------------|
| None/Slight | Ant.                    | 3                          | 5                            | 5                            | 13                  |
|             | Post                    | <u>5</u>                   | <u>10</u>                    | <u>14</u>                    | <u>29</u>           |
|             | Total                   | 8                          | 15                           | 19                           | 42 (86.0%)          |
| Severe      | Ant.                    | 1 (25%)                    | 0 (0%)                       | 0 (0%)                       | 1                   |
|             | Post                    | <u>2 (28.6%)</u>           | <u>2 (16.7%)</u>             | <u>3 (17.6%)</u>             | 7                   |
|             | Total                   | <u>3 (27.3%)</u>           | <u>2 (12.5%)</u>             | <u>3 (13.6%)</u>             | <u>8*** (16.0%)</u> |
| Case Total  | 11                      | 17                         | 22                           | 50                           |                     |

\*Group I-B. One appointment fills. Trephined. In the 50 cases there were no cases of severe pain.

\*\*Anterior = Central - Cuspid Posterior = Bicuspid - Molar

\*\*\*8 Cases severe pain relieved by trephination

TABLE II

Pain Following Root Canal Treatment in Group II  
Two Appointment Fills

| <u>Pain</u> | <u>Tooth<br/>Position</u> | <u>Fill Overs<br/>Extended</u> | <u>Fill<br/>&lt;1 mm to Apex</u> | <u>Fill<br/>&gt;1 mm to Apex</u> | <u>Total<br/>Cases</u> |
|-------------|---------------------------|--------------------------------|----------------------------------|----------------------------------|------------------------|
| None/Slight | Ant.                      | 12                             | 30                               | 4                                | 46                     |
|             | Post                      | <u>11</u>                      | <u>30</u>                        | <u>26</u>                        | <u>67</u>              |
|             | Total                     | 23                             | 60                               | 30                               | 113 (90.4%)            |
| Severe      | Ant.                      | 4 (2.5%)                       | 3 (9.1%)                         | 1 (20.0%)                        | 8                      |
|             | Post                      | <u>2 (15.4%)</u>               | <u>1 (3.2%)</u>                  | <u>1 (6.2%)</u>                  | <u>4</u>               |
|             | Total                     | 6 (20.77%)                     | 4 (6.3%)                         | 2                                | 12* (9.6%)             |
|             | Case Total                | <u>29</u>                      | <u>64</u>                        | <u>32</u>                        | <u>125</u>             |

\*11 of 12 pain cases relieved by trephination and one not relieved. Procedural question.

TABLE III

Incidence of Severe Pain Following One-Appointment  
Root Canal Filling When Immediately Trephined or Not Trephined

| <u>Pain</u> | <u>Group I-A<br/>Not Trephined</u> | <u>Group I-B<br/>Trephined</u> | <u>Total Cases</u> |
|-------------|------------------------------------|--------------------------------|--------------------|
| None/Slight | 42                                 | 50                             | 92                 |
| Severe      | 8                                  | 0                              | 8                  |
|             | —                                  | —                              | —                  |
|             | 50                                 | 50                             | 100                |

df = 1

 $x^2 = 8.69$ 

p &gt; .99

TABLE IV

## Incidence of Severe Pain in Relation to Immediate Trephination

| Pain        | Group I One Appointment Fills |              | Group II<br>Two Appointment<br>Fills | Total<br>Cases |
|-------------|-------------------------------|--------------|--------------------------------------|----------------|
|             | A. Not Trephined              | B. Trephined |                                      |                |
| None/Slight | 42                            | 50           | 113                                  | 205            |
| Severe      | 8                             | 0            | 12                                   | 20             |
| Total Cases | 50                            | 50           | 125                                  | 225            |

df = 2     $\chi^2 = 8.07$      $p > .98$

TABLE V

Incidence of Severe Pain Following 1 or 2 Appointments  
Fills With and Without Immediate Trephination

| <u>Pain</u>        | <u>Group I-A and<br/>Group II</u> | <u>Group I-B<br/>Trephined</u> | <u>Total Cases</u> |
|--------------------|-----------------------------------|--------------------------------|--------------------|
| None/Slight        | 155                               | 50                             | 205                |
| Severe             | <u>20</u>                         | <u>0</u>                       | <u>20</u>          |
| <u>Total Cases</u> | 175                               | 50                             | 225                |

df = 1

 $\chi^2 = 6.2717$ 

p &gt; .98

TABLE VI

Incidence of Pain in Relation to  
Whether Filling Overextended

| <u>Pain</u> | <u>Overextended</u> | <u>Apex or<br/>Short</u> | <u>Total<br/>Cases</u> |
|-------------|---------------------|--------------------------|------------------------|
| None/Slight | 31                  | 124                      | 155                    |
| Severe      | 9                   | 11                       | 20                     |
|             | —                   | —                        | —                      |
| Total       | 40                  | 135                      | 175                    |

df = 1       $\chi^2 = 6.27$        $p > .988$

TABLE VII

Incidence of Severe Pain in Relation  
to Canal Filled Less Than or More Than 1 mm Short

| <u>Pain</u> | <u>&lt;1 mm</u> | <u>&gt;1 mm</u> | <u>Total Cases</u> |
|-------------|-----------------|-----------------|--------------------|
| None/Slight | 75              | 49              | 124                |
| Severe      | 6               | 5               | 11                 |
|             | —               | —               | —                  |
| Total       | 81              | 54              | 135                |

df = 1       $\chi^2 = 0.14846$       p > .00

TABLE VIII

Incidence of Severe Pain in Relation to  
 Root Canal Treatment Being Completed in One or Two Appointments

| <u>Pain</u> | <u>Group I-A<br/>Not Trephined</u> | <u>Group II<br/>Not Trephined</u> | <u>Total<br/>Cases</u> |
|-------------|------------------------------------|-----------------------------------|------------------------|
| None/Slight | 42                                 | 113                               | 155                    |
| Severe      | 8                                  | 12                                | 20                     |
|             | —                                  | —                                 | —                      |
|             | 50                                 | 125                               | 175                    |

For incidence of pain  $df = 1$        $\chi^2 = 1.45$        $p > .77$

TABLE IX

Incidence of Overfill in Relation to  
the One Appointment or Two Appointments

| <u>Appointments</u> | <u>Group I; A &amp; B<br/>Overfilled</u> | <u>Group II<br/>Filled Flush<br/>or Short</u> | <u>Total<br/>Cases</u> |
|---------------------|--|---|------------------------|
| One Appointment     | 22                                       | 78  | 100                    |
| Two Appointments    | <u>29</u>                                | <u>96</u>                                     | <u>125</u>             |
| Total               | 51                                       | 174   | 225                    |

df = 1

 $\chi^2 = 0.0456$ 

p &gt; .05

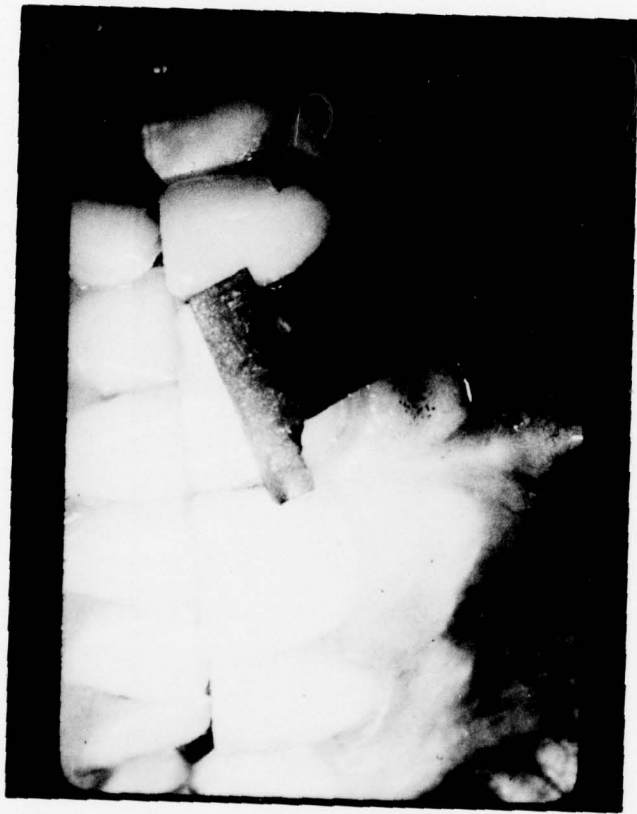


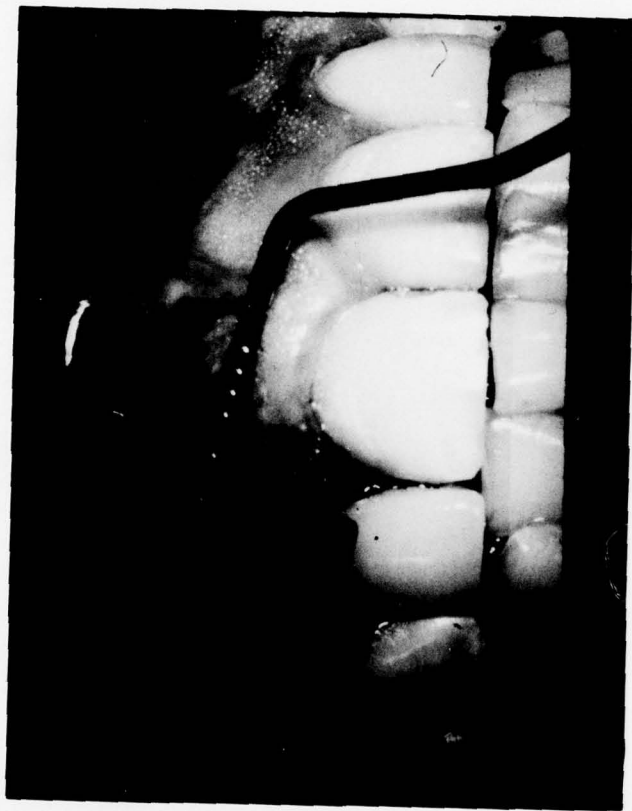




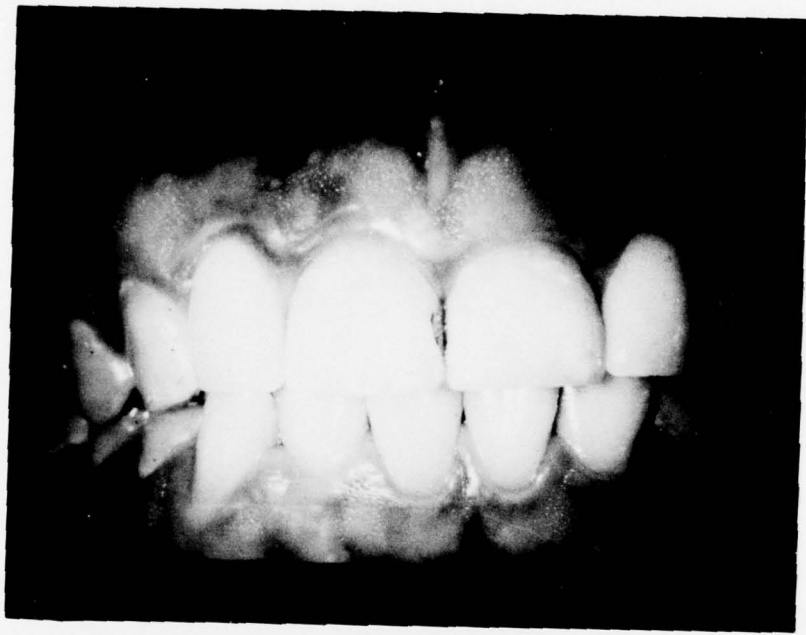












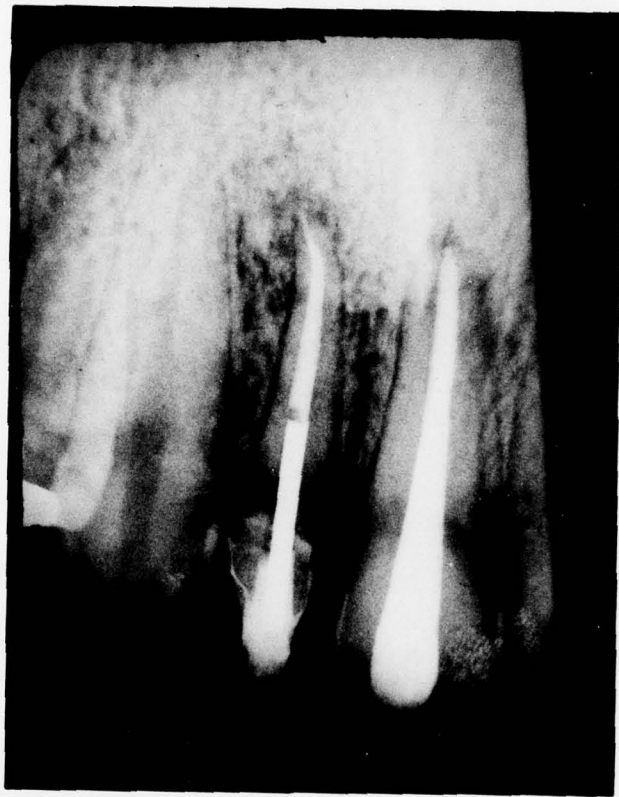










TABLE X

Incidence of Severe Pain in Relation to Tooth  
Position, Anterior or Posterior Whether Filled After One  
or Two Appointments

| <u>Symptoms</u> | <u>Anterior<br/>Cent, - Cuspid</u> | <u>Posterior<br/>Bicuspid - Molars</u> | <u>Total<br/>Cases</u> |
|-----------------|------------------------------------|--|------------------------|
| None/Slight     | 59                                 | 96                                     | 155                    |
| Severe          | 9                                  | 11                                     | 20                     |
|                 | —                                  | —                                      | —                      |
|                 | 68                                 | 107                                    | 175                    |

df = 1       $\chi^2 = 0.358$       p > .45