

1-10

PREVENTION OF COMPLICATIONS

II. PATIENT PREPARATION,
MONITORING AND STAFF

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1-10-1: FASTING1-10-1a: Relaxation of fasting rules

One criticism levelled against those practitioners using the M.I.T. is that they relax the rules of fasting. Bell (1975f) says that the widespread relaxation of the rule of fasting must be a factor in increasing potentially fatal incidents.

Even under conscious sedation techniques, there is some obtundation of the gag reflex. Radio-opaque dyes have been demonstrated to enter the lung (see Section 1-7-2).

Weinstock (1960) and Lyon (1961) will give methohexitone to a patient who has a full stomach, for the emergency extraction of one or two teeth. Barbiturates do not stimulate vomiting, but because hypoxia does, Weinstock (1960) gives the unfasted patient 100% oxygen during treatment.

Shane (1975c) will not necessarily cancel an intravenous *amnesia* session because a patient has not fasted.

Berns (1963) gave methohexitone to 300 premedicated patients, all of whom had eaten within four hours, and none vomited.

Hudson (1965) feels that: *Over-starvation sometimes results in regurgitation of contents from the small intestine, and these digestive enzymes can make the throat very sore.* He suggests a cup of tea with a little milk and a small piece of dry toast 2-3 hours beforehand.

1-10-1b: Recommended fasting times

In Table 10-1 below, I have listed recommendations made about

fasting before methohexitone. Some authors allow a liquid to be taken closer to the appointment.

TABLE 10-1: FASTING RULES		
NAME OF AUTHOR	HOURS MUST FAST	HOURS FOR LIQUIDS
Goldman (1968)	3-4	
Lyon (1960)	4	2
Weinstock (1960)	4	
Bourne (1967L)	4	
Swiss (1967)	4	
Love (1968)	4	
Wilson, D.S. (1970)	4	2
Simpson & Rondeau (1966)	5	
Shane (1965c)	5	
Mann et al (1971)	6	4
Elliott et al (1974)	6	
Garber (1976)	8	6

1-10-1c: Conclusion

Why practitioners should relax the rules of fasting is hard to understand.

In some ways it may be related to patient demand - the apparent trivial nature of a short dental procedure under the M.I.T. may not be seen in the same light as a hospital anaesthetic.

Fortunately methohexitone produces a low incidence of vomiting (see Section 1-7-14a).

1-10-2: CONSENT

Before a patient receives methohexitone it is important that he understands the implications of the procedure and that he will adhere to the pre and postanaesthetic instructions.

Polyblank (1974) suggests a consent form which the patient signs. The consent form also includes a brief medical history questionnaire (see also 1-9-2b).

The Hospitals' Commission suggests the following guides concerning age of consent (Frost 1973):

AGE OF PATIENT	CONSENT TO BE OBTAINED FROM:
Under 14 years	Parent or guardian
14-16 years	Parent or guardian and patient
16-18 years	Patient only. If accompanied by parent or guardian, then they too
Over 18 years	Patient

1-10-3: PRE-OPERATIVE REST PERIOD

O'Brien (1974) states that: *The nearer the patient is to basal metabolic conditions, the lower his circulating catecholamine levels, the lower is his oxygen consumption, the less susceptible is he to the cardiac effects of drugs.* He recommends that a patient should arrive half an hour beforehand.

During the rest period the patient can use the toilet and loosen his clothes - as recommended by Weinstock (1960).

1-10-4: VENEPUNCTURE TECHNIQUE

The technique has been frequently described in the literature (e.g. S.A.A.D. Report 1972a; Chapman 1975) and it is not my intention to discuss it any further.

1-10-5: TEST DOSE

Miller et al (1976) reported a case of intra-arterial injection of methohexitone and advised that a test dose of 20mg of methohexitone should be given to ensure that the drug is entering a vein (see also Section 1-7-13b).

Lyon (1961), Clarke (1971a) and Mann et al (1971) gave a test dose of 20mg. A patient's sensitivity to the drug can also be tested in this way (see also Section 1-9-2c).

Bell (1975f) recommended a 20-40mg test dose, but warned that in some patients with a slow circulation the test dose may take longer to act. This could be mistaken for no effect and more methohexitone might incorrectly be given.

Wangeman (1962) gave 40mg rapidly, then waited 2-4 minutes to test results. In this way he decided on the size of the subsequent dose.

1-10-6: PRE-INDUCTION SWALLOW

Just before induction, Foreman (1967) asks his patients to clear their throats and swallow twice, as a precaution against secretions and possible spasm. (For smokers: see Also Sections 1-10-7, 1-7-2e(v)).

1-10-7: AIRWAY PROTECTION FOR M.I.T.

1-10-7a: Introduction

The anaesthetist, Macintosh (1976), has, . . . been asked quite a few times to lend a helping hand by dentists who have heard vaguely about the advantages offered by I.V. anaesthesia for conservative work, but they are unaware that certain basic knowledge and skills are needed from them, if the outcome is to be a success . . . unless the dentist plays his part competently, protecting the airway, chaos is likely to supervene no matter who the anaesthetist may be.

Christenson et al (1961) used the M.I.T. for oral surgery and stated that the technique relies very much on, . . . the close and understanding cooperation of the oral surgeon, who was cognizant of the airway-maintenance problem.

In their study of extractions under methohexitone, Young & Whitwam (1964b) found that a good airway could be maintained only by cooperation between operator and anaesthetist. Scrupulous attention had to be paid to prevent blood and debris entering the oropharynx; packs had to be frequently replaced and suction applied.

Drummond-Jackson (1967c) criticises the British Health Ministry Subcommittee's Report on Dental Anaesthesia (Swiss 1967) because there is no mention of . . . the importance of protection of the airway, of effective packing.

1-10-7b: Factors affecting airway protection

In the M.I.T., three factors are involved:

1. Adequate reflexes: frequently absent (see Section 1-7-2).

2. Good suction: will vary with the nurse's experience.
3. Efficient packing by the operator.

(from Mann et al 1971).

1-10-7c: Suction

When the S.A.A.D. ran its first M.I.T. course in 1958, low vacuum high velocity suction was unknown (Drummond-Jackson 1975c).

Minimum standards are discussed by Robinson (1970) and Polyblank (1974).

Suggested minimum standards as required by the N.S.W. Health Commission are presented in draft form in Newsletter (1976b).

1-10-7d: The pack

1-10-7d(i): Development

Safe mouthpacking is a study in itself (Southwell 1972).

The sponge mouth pack was first described by Drummond-Jackson (1954) and developed by the S.A.A.D. (Drummond-Jackson 1975c). Drummond-Jackson (1960) states: *Since the routine use of the flange packs I have had a spell of over 2000 consecutive administrations without a spasm.*

With meticulous care in placement, maintenance and change over, the damp cellulose flange pack has helped reduce the incidence of laryngeal spasm which had caused a widespread belief amongst anaesthetists that, in dental anaesthesia, thiopentone (and methohexitone) predisposed towards spasms (S.A.A.D. Report 1972c).

Allen (1972c) tried to put rubber dam in place during the M.I.T. but found that the recommended maximum dose was exceeded before treatment had started.

1-10-7d(ii): Responsibility for pack

Mandiwell (1971) says: *It is impossible for the anaesthetist to accept responsibility for the pack throughout light anaesthesia, as he cannot be expected to see its positioning and condition during operating.*

Buxton (1971b) suggested that for the M.I.T., the anaesthetist should take over the nurse's role and man the sucker. In this way he is in a much better position to observe the position of the pack and to maintain the airway.

There were two reported cases of a tooth being dislodged during treatment, getting past the pack and being inhaled by the patient.

One patient was a 4½ year old (Young 1970), and the other was an eleven year old (Medical Protection Society 1975b). In each case an anaesthetist was present. In each case judgement was against the dentist. In the first case the judge said that the dentist had failed to ensure an adequate airway.

In the second case, . . . *the anaesthetist had no further responsibility for the pack once he had ascertained that the throat was efficiently packed.*

1-10-7d(iii): Intubation as the solution

Many anaesthetists prefer to intubate patients rather than place this one-sided responsibility on to the operator (Unusual Problems 1973;

Tomlin 1974a).

Webb (1969) feels that there is no place for operating in an airway not guaranteed by an endotracheal tube, a view supported by Norman et al (1968).

Norman et al (1969) state: *Irrespective of how many dentists, doctors, or nurses are present it is virtually impossible to prevent coolant and debris entering the airway at some stage during the operation.*

Hodge (1971) insists on intubation general anaesthesia for long procedures for children or whenever the airway is endangered.

But the results from a survey of oral surgeons in the U.S.A. (Driscoll 1974) indicates that most of those who use methohexitone never intubate their patients.

1-10-8: POSITION OF THE PATIENT

1-10-8a: Recent studies

In Table 10-2 below, I have listed some recent studies in which the authors have stated the position their patients were treated in.

TABLE 10-2 POSITION OF PATIENTS IN SOME RECENT STUDIES	
STUDY	POSITION
Young (1974)	Upright
Rule et al (1967)	Semi-upright
Shafto (1969)	45 degrees
Allen et al (1969)	45 degrees
Andrew et al (1973)	30 degrees
Ryder (1976)	30 degrees
Campbell et al (1976)	30 degrees
Elliot et al (1974)	Cradled (almost supine)
Litchfield & Gerard (1971)	Supine
Mann et al (1971)	To suit surgeon

1-10-8b: Upright position may reduce risk of aspiration

Love (1968) reviewed the literature and concluded that the main reason why the traditional seated position has not yet been abandoned is because of the fear of risk of aspiration of debris into the trachea.

Quinn et al (1973) observed a higher incidence of laryngeal spasm in supine patients - because it is harder for the surgical assistant to keep a clean field.

Coplans (1967a) said: *I shall continue to teach that the supine position is unsuitable for routine use in the unintubated patient, in the hands of the dental practitioner who has received no postgraduate instruction in anaesthetics.*

Forsyth et al (1972) discuss the merits of five different positions for treatment under methohexitone. They feel that all supine patients should be intubated to maintain a clear airway and avoid inhalation of gastric juices. They prefer the semisupine position.

Garber (1976) reviewed the literature and made the same conclusions.

1-10-8c: Upright position aids respiration and circulation

The upright position was preferred by Christenson et al (1961) and Quinn et al (1973) because it allows greater respiratory exchange and less airway obstruction.

The recumbent position reduces tidal exchange by 10%. Although not significant in normal patients, the speed of arterial oxygen tension build-up would be severely reduced (Coplans 1962).

Danziger (1962) prefers the upright position for patients with a history of cerebral and coronary thrombosis and compensated heart failure.

The supine position should be avoided in late pregnancy and in cases of acute respiratory distress (Hannington-Kiff 1969).

1-10-8d: The advantages of the supine position

Bourne (1970c) states: *Dental patients undergoing general anaesthesia should be treated lying down.*

S.A.A.D. (1971) states: *Unfortunately it is still accepted practice in most hospitals and surgeries to anaesthetise the patient in the upright position, instead of in the flat position.*

Bell (1975g) prefers the word horizontal which he says is more precise than supine.

Huddy (1966) says that the inhalation of tooth fragments is more likely to occur if the patient is upright.

In order to decrease the risk of inhalation of debris during anaesthesia, Love (1963) recommends the supine position but with a further 5-15 degrees head-down tilt.

1-10-8e: Conclusion

If patients are sitting up for dental treatment under methohexitone, an unrecognised faint could develop. Brain damage and even death could result.

The position of the patient is also discussed in Sections 1-7-10d, post operative hypotension; 1-7-11, fainting; 1-13-5b, deaths.

1-10-9: MONITORING

1-10-9a: Monitoring used in studies

1-10-9a(i): Respiration

It is difficult to get quantitative results because the work is carried out in the mouth, but Robinson et al (1969) used a bellows system around the patient's chest which gave qualitative results.

Mann et al (1971) took continuous recordings with the aid of a mercury-in-rubber strain gauge placed around the patient's chest.

Elliott et al (1974) measured tidal volumes at the end of anaesthesia. Campbell et al (1976) used a *Statham Strain Gauge* around the chest.

1-10-9a(ii): Oxygen tension

Although not as precise as direct blood analysis, a *Water's Oximeter* with earpiece transducer, was used by Mann et al (1971) for comparisons.

Direct measurement of arterial oxygen levels can give instant indication of change in respiration (Robinson et al 1969b).

Campbell et al (1976) took blood gas readings from the radial artery (see also Table 7-13 in Section 1-7-5b).

1-10-9a(iii): E.E.G.

Because barbiturates produce a characteristic pattern, the E.E.G. can be used to assess level of anaesthesia (Robinson et al 1969b).

1-10-9a(iv): Blood pressure

Blood pressure should be recorded preoperatively and periodically in all procedures lasting longer than 10-15 minutes (Bennet 1974s).

This is standard hospital practice (Editorial 1975a). However, O'Brien (1974) records blood pressure only in elderly patients or when the procedure is lengthy.

Shafto (1969) found that the monitoring of blood pressure was *difficult & unsatisfactory* . . . His patients were young, apprehensive and, *In these circumstances the taking of pre-operative blood pressure reading often destroyed the patients co-operation* . . .

Similarly in his study, Young (1974) did not record blood pressures, *because placement of a cuff beforehand may disturb the anxious patient and might have altered the response to induction.*

Weinstock (1960) routinely recorded blood pressure before commencing. Redish et al (1968) recorded blood pressure at least nine times before, during and afterwards.

Mann et al (1971) took regular readings whenever possible. Quinn et al (1973) took readings every 2-3 minutes.

Elliott et al (1974) state, *Vital signs were not recorded during the operative procedures . . .* but took blood pressure readings before and after in 100 consecutive cases of the 800 patients they treated.

Southwell (1976) took readings at different times throughout his study.

1-10-9a(v): Heart rate

(i) Pulse monitors

Foreman (1967) considers that pulse monitoring apparatus is a useful, but not essential aid.

Goldman (1968) keeps a finger on the pulse throughout short procedures. Whilst holding the patient's jaw, the facial pulse can be easily felt.

A continuous record of digital pressure using a photo-electric devise on the finger gives a useful percentage change of blood pressure (Mann et al 1971).

There seems to be a strong case for the use of a pulse monitor which at least would give warning of a faint (Editorial 1975a).

Pulse monitors may be better than instruments based on electrical signals from the heart in cases where marked changes in heart rate occur. Where the heart has ceased to function, electrical signals may still persist (Blatchley & Drummond-Jackson 1971b).

Pulse monitors are unreliable for detecting arrhythmias (Sara 1975).

Goldman (1968) uses a pulse monitor if procedure is to take longer than five minutes. Bennett (1974s) checks pulse continuously. Bourne (1974b) feels the pulse before, during and after induction, and during and after anaesthesia.

Southwell (1976) used a finger plethysmograph attached to an oscilloscope to monitor pulse rate and rhythm.

(ii) E.C.G.

For short procedures on healthy patients, Trieger (1974c) does not think it necessary to use an E.C.G.

An E.C.G. will reveal changes in rate or rhythm of the heart and show any severe degree of myocardial hypoxia (Robinson et al 1969b).

Because of the high incidence of arrhythmias with outpatient anaesthesia for oral surgery, Garber (1976) recommends the E.C.G. in such cases, and also for long conservation sessions.

Mann et al (1971) took E.C.G. readings for one minute in every

five. Elliott et al (1974) used the E.C.G. on 100 of their patients. Campbell et al (1976) and Southwell (1976) also used the E.C.G.

1-10-9b: Value of complex monitoring questioned

1-10-9b(i): Value of B.P. readings questioned

Many pre-operative recordings, taken to establish baselines, may be false because of apprehension, or unfamiliar surroundings, or the presence of a cannula in an artery (Foreman 1974a).

Measuring blood pressure alone is insufficient to show that no significant changes have taken place. Peripheral resistance may have fallen but cardiac output has increased to compensate, and blood pressure remains the same (Robinson et al 1969b).

Intermittent measurement of arterial blood pressure by conventional sphygmomanometers does not reveal transient changes in arterial blood pressure. Robinson et al (1969b) suggest that blood pressure should be continuously recorded via an indwelling cannula using an electromanometer.

1-10-9b(ii): Respiratory complications despite monitoring

Complications have occurred despite elaborate monitoring: Wise et al (1969) reported cyanosis in 10% of cases. (See also Robinson et al (1969).)

Of this study, Holden (1969a, 1969b) asks: *The question arises why experienced anaesthetists, with a vigilant laboratory team, permitted episodes of obstruction to last up to 2 minutes without correction.*

1-10-9c: Simple monitoring methods

A simple method for listening to pulse rate, pulse rhythm, and breathing sounds is the precordial or suprasternal stethoscope (Quinn et al 1973; Trieger 1974c).

Marcy (1974) comments: *Most important, and the only device necessary for the short case, is the precordial stethoscope. We believe that this is mandatory for any case regardless of duration.*

To avoid complications, close attention must be paid to the patient's eyes, carotid pulse, airway and respiration at all times (Foreman 1967).

The need for monitoring equipment depends on the length of the case and the experience of the administrator (Goldman 1968).

Macintosh (1976) says: *Don't rely on electronic monitors to keep you on a safe course. Of what use in the dental surgery (except for research purposes) is an electrocardiogram?*

1-10-9d: Conclusion

The most important aspects are heart rate and respiration. Both should be easily monitored in the dental situation, without the need for complex equipment.

In young, healthy patients who are to have a short anaesthetic, it is probably unnecessary to take frequent readings of blood pressure.

1-10-10: EQUIPMENT1-10-10a: Frequent lack of emergency equipment

In reports of inquests one reads of dental chairs which cannot be put into the horizontal position, oxygen supplies which are exhausted within a few minutes, lack of facilities for intubation, and even of assistants visiting the local chemist shop to purchase supplies of adrenalin after cardiac arrest has occurred (Editorial 1975).

1-10-10b: Adequate minimum equipment

Lists of adequate minimum equipment have been made by Foreman (1966, 1969d), Robinson (1970), Southwell (1972), O'Brien (1974) and Litchfield (1975). In 1976, the Australian Dental Association sent a draft list of minimal equipment standards for resuscitation in dental surgeries, to all members in N.S.W. (Newsletter 1976b).

An anaesthetist in Perth has set up a facility for outpatient dental anaesthesia (Excerpts 1974). It consists of a fully equipped theatre but with all the necessary dental equipment too. In this case dentists bring their patients to the clinic, along with their own dental nurse. The clinic provides all necessary anaesthetic staff.

In Sydney, Morton (1976) has equipped two surgeries to be used exclusively for dentistry under anaesthesia on an outpatient basis. The surgeries have been equipped to standards recommended by the N.S.W. Health Commission.

I have therefore, commented only on items of particular interest.

1-10-10c: Armboards

Wilkinson (1968) designed the modern armboard.

1-10-10d: Needle Gauge

Mann et al (1971) used a 20 gauge needle. For children, Andrew et al (1973) used a 26 gauge needle, and Shafto (1969) used a 26 gauge needle.

1-10-10e: Syringe and extension tubing

The system as described by Foreman (1966) has been improved. The old system with taps, tubes, stock bottles, can increase the possibility of cross-infection.

Green (1974) says that the use of irradiated, one-use needle-extension tubes and syringes are responsible for the large advance in intravenous techniques.

1-10-10f: Removal of needle

The needle should not be removed from the patient's vein until the patient is awake and can obey verbal commands. In this way, if an emergency did develop, access to a vein is maintained (Quinn et al 1973).

1-10-10g: Mouth props

Under light methohexitone anaesthesia, mildly resistant patients may exert excessive biting forces on the mouth prop. Hubbell & Royer (1963) describe one patient who fractured his mandible during the waking stage after an impacted third molar had been extracted. For these patients, they recommend deeper anaesthesia until the bite block is removed.

Shafto (1969) never inserts the bite block prior to induction because of adverse psychological effects; Andrew et al (1973) inserts the prop *immediately after induction*.

Buxton (1971a) warns against using too large a prop in children because of the danger of overextension of the T.M.J. and complete occlusion of the nasal airway.

1-10-10h: Aid for jaw support

With the M.I.T., the nurse usually has to help maintain the patient's airway by supporting the jaw (Hodge 1971).

Ormsby & Bloomfield (1973) have devised a method of eliminating this fatigue for long cases by using a surgical collar to maintain the patient's head in hyperextension.

1-10-10i: Recovery facilities

Litchfield (1974) states: *During the recovery phase a close watch on the patient is maintained. The patient should be assisted to a nearby car, taken home and cared for for several hours afterwards.*

Trieger (1976) said that postoperative care for ambulatory patients cannot be as good as for hospitalised patients.

Recovery from methohexitone is discussed in Section 1-12.

1-10-10j: Conclusion

Plenty of information exists on minimum standards of equipment and facilities - sometimes these have not been adhered to in the past.

1-10-11: STAFF REQUIREMENTS

1-10-11a: Teams used in studies

Hatt et al (1971) gave more details, of a dental interest, of their study: Mann et al (1971). At all times during the study, six

people were present in the surgery:

1. Patient
2. Anaesthetist
3. Surgeon
4. Monitoring technician
5. Nurse
6. Nurse

For oral surgery, Quinn et al (1973) had three assistants:

1. Anaesthetic assistant
2. Surgery assistant
3. Instrument nurse

The anaesthetic assistant supported the patient's head and monitored respiration.

Litchfield (1974) describes a technique utilising surgeon, nursing sister and dental nurse; and he states that, . . . *no anaesthetist is required to be present in addition to the operator although another dentist nearby is useful to assist if the patient proves difficult under the sedation.*

Grainger (1970a) used a similar team in his M.D.S. study.

In Southwell's (1976) study the operating team consisted of one dentist and two senior chairside assistants. One of these assistants was responsible for monitoring.

1-10-11b: Training of nursing staff

Bourne (1967p) suggests that two *suitably* trained nurses are

required for the M.I.T.

Bourne (1967o) says that dental nurses should be trained in the care of the unconscious patient.

Macintosh (1976) states: *I have no doubt that it is an easy matter to train a conscientious, alert and reasonably intelligent girl to detect degrees of respiratory obstruction or depression.*

But few dental nurses are adequately trained (Editorial 1975a).

The British Health Ministry Report on Anaesthesia (Swiss 1967) stated that dental nurses lack *the fundamental knowledge to administer an anaesthetic safely or even help effectively in an emergency.*

For this type of work, highly trained and competent registered nursing staff are essential (Foreman 1966, 1969d).

Quinn et al (1973) recommends that a solo practitioner should get a certified nurse to act as anaesthetic assistant, but he does say: *It has been our experience that an intelligent mature person with a high school education, or perhaps one year of training in an approved dental assisting program, can be trained to perform the duties of an anaesthesia assistant.*

1-10-11c: Second professional

Webb (1969) says, . . . *dental surgeons as a whole are the step children of surgery at the moment because . . . (they) . . . have found it very difficult to obtain professional anesthesia of a high caliber for their work.*

Drummond-Jackson (1971a) estimated that over 50% of consultant

anaesthetists in Britain have never given a dental anaesthetic.

Drummond-Jackson (1971b) adds that it is difficult for an anaesthetist experienced only in hospital-type anaesthesia to achieve the delicacy of threshold ultra-light anaesthesia.

The situation in Britain is still the same. Sykes (1976) says that it is this lack of trained dental anaesthetists that places pressures on dentists to administer their own anaesthetics.

Bourne (1970a) feels that the availability of manpower could be overcome if paramedical anaesthetists became available. These people could be science graduates and would be just as safe as the operator-anaesthetist.

Tomlin (1974b) says, . . . *the anaesthetic hazard for the brief dental extraction lasting 10-30 seconds is probably not increased by this dual role.* But he feels that the operator-anaesthetist should be banned and, in discussing four deaths that year, he predicted that more will occur. He suggested that the defence societies should not defend those who use the method - as an effective way of stopping the practice.

Bourne (1974b) however, points out that the incidence of mortality is no higher than that with a separate anaesthetist.

Blatchley (1974c) said: *No one can deny that a fully anaesthetized patient needs the services of a separate person . . . but does this per se make anaesthesia safer? Deaths have occurred with an operator anaesthetist in action and also with a separate anaesthetist of all three groups - dentist, general medical practitioner, and specialist anaesthetist.*

The British Medical Journal (Editorial 1975a) admits that very experienced operator-anaesthetists have successfully practised for years, but inexperienced and recently qualified practitioners have also acted as operator-anaesthetists and have featured in cases with unsuccessful outcomes.

Please refer to Section 1-13 for discussion of deaths under methohexitone.

Hubbell & Royer (1972) predicted that: *The cost would be prohibitive if, for every procedure, the patient would be asked to pay fees for the separate services of a dentist and an anesthesiologist. Too many patients need too many dental procedures to allow fees for both to be economically realistic.*

This view is shared by the British Office of Health Economics (1976).

1-10-11d: Role of second professional in the M.I.T.

Bourne (1967p, 1971b) discusses the role of a second professional. Either:

1. To help with complications? But, he says, these are very rare, and not difficult to treat. Operator is in best position to treat (e.g. vomiting).
2. Assess fitness for treatment? But, he says, the operation is trivial and the depth of anaesthesia light. A simple history should suffice.
3. Help the inexperienced? Yes.

He feels that the operator-anaesthetist would be acceptable if:

1. He is properly trained
2. He is assisted by two sisters
3. For easy dental cases
4. For short dental cases

1-10-11e: Conclusions

That there is little support for the dual roles of operator-anaesthetist is forthcoming from:

1. The Journals (B.D.J. 1962; Editorial 1975; Editorial 1976b; Sheridan 1977b).
2. The defence societies (Constable 1964; Medical Protection Society 1975a; Rowe 1976).
3. The British Dental Association (B.D.A. Report 1966; B.D.A. Paper 1967).
4. Leading authorities (Bourne et al 1964; Goldman 1968, 1973; Howells 1968; Shafto 1969; Helmore 1969a; Bourne 1973b).
5. S.A.A.D. (Drummond-Jackson 1971a).
6. A.S.A.A.S.D. (Somers 1976).

However, there is some doubt on the ability of a separate anaesthetist to satisfactorily monitor, and ensure a clear airway under the M.I.T. It would appear that in this technique, and other non-intubated techniques, the responsibility for these must lie with the operator (see Section 1-10-7d(ii)).

It is difficult for a separate person to correctly judge dosage levels with the M.I.T. It would appear that when a second person does so, patients are usually overdosed (see Section 1-5-7d).

It is often argued that in fact, the M.I.T. is not an anaesthetic technique, and can be used purely as an amnesic with all reflexes intact, particularly if local anaesthetics are used as well. Thus the question of the operator-anaesthetist may not arise (see Section 1-11-4).

However, it has been found that the presence of reflexes is by no means an indication of lightness. When using a drug such as methohexitone, there is no guarantee that anaesthesia will not occur (see Section 1-5-8a).

If it is accepted that a second person should be present to administer the drug, and to monitor cardiorespiratory system, the question arises, who should that second person be? To have another trained professional, especially if he is a specialist, may place an unrealistic economic burden on patients and health insurance systems.

Various alternatives have been suggested.

In my opinion, a well trained dentist will be fully aware of the limitations of the M.I.T. and will use it only as an operator-anaesthetist in the following circumstances:

1. To cover the administration of local analgesia
2. Emergency treatment
3. He is assisted by a trained nursing sister
4. Healthy patients. Young adults
5. Not used in combination with respiratory depressants (see Section 1-11-6f).

It would be unfortunate if the clinical freedom of the dentist to use the M.I.T. under these circumstances was removed.

1-10-12: GENERAL CONCLUSIONS

1. The rules of fasting should not be relaxed, even though methohexitone produces a low incidence of vomiting.
2. The patient must understand fully the treatment he will receive with methohexitone, and his written consent should be obtained.
3. Patients should be allowed some time to rest before induction.
4. A 20mg test dose should be given to gauge effect and to help in determining further doses.
5. Patients should be asked to clear their throats before induction.
6. Dentistry is messy and great care must be exercised in maintaining a clear airway: Good suction equipment and proper packing are essential. These skills take time to acquire.
7. Although intubation may help in maintaining a clear airway, it seems a rather drastic procedure for very short simple techniques.
8. Patients receiving methohexitone must be supine.
9. Correct monitoring of the patient under methohexitone is probably the most important aspect - but simple monitoring procedures should suffice without the necessity for complex equipment.
10. Every practitioner should equip his surgery with the adequate equipment for resuscitation.
11. Dentists should be well trained and know the limits of the M.I.T. The operator-anaesthetist should be permitted only in certain circumstances. (see Section 1-10-11e).

12. Nursing staff should be also highly trained in the care of unconscious and recovering patients.
13. Recovery facilities should equal those found in any hospital.
(See Section 1-10-10b.)

1-11

SUPPLEMENTS

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1-11-1: INTRODUCTION

Methohexitone has been used in combination with many drugs. In this section I have attempted to bring some order to what seemed to me, a complex array of techniques, which are very confusing because of the number of drugs involved.

As each group of drugs is discussed, I have drawn conclusions and at the end, I have drawn general conclusions.

1-11-2: OXYGEN

1-11-2a: Discussion

For short procedures under methohexitone, Recant (1960) allowed his patients to breathe 100% oxygen throughout.

Quinn et al (1973) recommend that after a 20mg test dose of methohexitone, patients should breathe 100% oxygen for one minute before further methohexitone is administered.

Allen (1972a) advised that the falls in blood oxygen levels reported with the M.I.T., could be avoided if 100% oxygen was also given (see Table 7-13, Section 1-7-5b).

However, on S.A.A.D. postgraduate courses, it has been taught that no advantage is served by giving healthy patients 100% oxygen before or during intravenous anaesthesia (Blatchley & Drummond-Jackson 1971c).

The S.A.A.D. has been criticised for not advocating the routine use of oxygen to supplement methohexitone (Forman 1975).

Although, when he was President of S.A.A.D., Blatchley (1974c) stated that, *all patients subject to intravenous depressant drugs should inhale oxygen, or a mixture of nitrous oxide containing at least 50% oxygen.*

The Editor of the British Medical Journal (Editorial 1975) says that there is a powerful case for raising the inspired oxygen concentration, if barbiturates are to remain the anaesthetics of choice.

1-11-2b: Conclusion

1. The benefit of oxygen supplementation in the presence of respiratory depression, partial respiratory obstruction and reduced cardiac output, caused by methohexitone, has been discussed in Section 1-7-5.
2. Its use is advisable.

1-11-3: NITROUS OXIDE

1-11-3a: History of association with methohexitone.

Nitrous oxide is a weak anaesthetic agent (Bourne 1960; Price 1975a) but its potency is significantly increased when combined with a barbiturate (Tatum 1939).

Early reports of methohexitone for dental treatment included supplementation with nitrous oxide and oxygen. For example, Redish et al (1958) induced patients with a small dose of methohexitone (average 50mg), maintained anaesthesia with nitrous oxide and oxygen, and if necessary, gave further increments of methohexitone.

More recently, the technique of relative analgesia has been combined with methohexitone (Southwell 1976).

1-11-3b: Advantages of nitrous oxide supplementation

1-11-3b(i): To aid venepuncture

The *Reimer* technique was used by Weinstock (1960) on children who would not submit to venepuncture. They were allowed to breathe 90% nitrous oxide and 10% oxygen until a light analgesic plane was reached. Venepuncture was then made and 30-50mg methohexitone administered. If the planned procedure was to be short, they were then allowed to breathe 100% oxygen, or if long, they were given 75% nitrous oxide for maintenance.

A comment is made on recommended maximum concentrations for nitrous oxide in Section 1-11-3c.

1-11-3b(ii): To reduce total dose of methohexitone

Price (1975a) warns of the danger of unintentional overdosage, with barbiturates, when nitrous oxide is also given.

However, it is possible to use the sedative effects of nitrous oxide and reduce methohexitone dosage.

Hubbell & Royer (1963) were able to induce old or debilitated patients with only 20-30mg methohexitone if they were first given nitrous oxide and oxygen to breathe.

For treatment times averaging 65-75 minutes, Southwell (1976) averaged 125-155mg methohexitone on patients who also received relative analgesia and diazepam (see also Section 1-11-6h).

1-11-3b(iii): To reduce jactitations

Whitwam & Manners (1962) used methohexitone as sole anaesthetic. They found that the majority of patients with tremors did not respond

to further increments of methohexitone, but did respond to nitrous oxide and oxygen. Jactitations is discussed in Section 1-7-1j, k, L.

1-11-3b(iv): Restless patients

Patients who were previously resistant to methohexitone alone were successfully treated by Wilkinson et al (1965) with nitrous oxide supplementation.

Forman (1971) recommends waiting thirty seconds after nitrous oxide administration has begun before commencing treatment. This would allow time for elimination of some nitrogen from the lungs as recommended by Hellewell & Hutton (1967) - although they suggested waiting two minutes.

Rollason (1971) and Andrew et al (1973) recommended similar techniques but sometimes found it necessary to use halothane as well. (Restlessness is discussed in Sections 1-5-8b and 1-9-2f.)

1-11-3c: Effect on peripheral resistance

Campbell et al (1976) stated that nitrous oxide counterbalanced the drop in peripheral resistance normally caused by the combination of methohexitone, diazepam and fentanyl used in their study.

However, Southwell (1976) measured physiological responses of patients receiving similar drug combinations and found, *Some of the peripheral vasodilation could probably be attributed to nitrous oxide.*

It is a well established fact that nitrous oxide causes dilatation of the superficial veins which may facilitate venepuncture (Treiger & Carr 1972), therefore it must contribute to a lowering of peripheral resistance. Peripheral resistance is discussed in Section 1-7-9.

1-11-3d: Concentrations used in studies

In Table 11-1 below, I have ranked, in decreasing percentage concentration, those studies which have used nitrous oxide supplementation:

TABLE 11-1: CONCENTRATION OF NITROUS OXIDE IN STUDIES			
NAME OF STUDY	NITROUS OXIDE %	OXYGEN %	COMMENTS
Myers & Coltman (1961)	88	12	+ trichlorethylene
Swerdlow (1962)	85	15	
Hellewell & Hutton (1967)	84	16	
Wilkinson et al (1965)	80	20	
Forman (1971)	80	20	
Redish et al (1958)	75	25	
Lyon (1961)	75	25	
Hubbell & Royer (1963)	75	25	
Allen et al (1969)	70	30	
Campbell et al (1976)	70	30	
Recant (1960)	50	50	aged sometimes + halothane sometimes + halothane
Hubbell & Royer (1963)	50	50	
Drummond-Jackson (1971d)	50	50	
Rollason (1971)	50	50	

Hellewell & Hutton (1967) found that they achieved best results with 16% oxygen and 84% nitrous oxide for extractions. They saw no cyanosis and had good operating conditions in 96.5% of cases.

The use of nitrous oxide is more likely to produce postoperative

vomiting (Swerdlow 1962) and it may cause unpleasant spinning sensations (Berns 1963).

1-11-3c: Conclusions

Probably these complications result from the use of high concentrations of nitrous oxide and 70% may cause hypoxia. The current limit is 65% (Price 1975a).

The new relative analgesia techniques, as recommended by Stacy (1974) and used by Southwell (1976), utilise lower concentrations of 25-60% nitrous oxide.

1-11-4: LOCAL ANALGESICS

1-11-4a: Discussion

Everett & Allen (1970) stated that, *minimal physiologic upset is assured only when regional anesthesia is complete, and intravenous drugs are used only to alleviate fear and apprehension.*

In 15 cases of dental treatment with the M.I.T. supplemented by local analgesia, Young (1970) observed less restlessness, respiratory obstruction and coughing, compared to 25 cases with the M.I.T. only.

Green (1963) used methohexitone, by continuous drip, and local analgesia for general surgery lasting at least one hour. He found that the mean recovery time was 8.7 minutes after stopping the administration of methohexitone.

He noted, *this rapid recovery after prolonged administration of methohexitone can be of advantage in many other surgical procedures where light sleep is desirable and the operation itself is painless or*

can be made so by local anaesthesia.

Bell (1975d) feels that the M.I.T. is made safer if local analgesia is also given and the patient is not depressed beyond the stage of the ability to respond to the spoken word.

Southwell (1976) observed physiological responses to various sedation techniques in 20 patients. He found that the use of local analgesia made it possible to carry out similar work at lighter levels of sedation.

Supplementation of methohexitone with local analgesics may also help to reduce the incidence of arrhythmias (see Section 1-7-7b(ii)) and to reduce elevations of blood pressure due to surgical stimuli (see Section 1-7-10c).

1-11-4b: Examples of supplementation of methohexitone with L.A.

Table 11-2 below lists some studies in which local analgesia has been used to supplement methohexitone. The studies are grouped in such a way as to highlight the reason for using local analgesia supplementation.

TABLE 11-2 SUPPLEMENTATION OF METHOHEXITONE BY LOCAL ANALGESIA		
AUTHOR	TREATMENT	REASON L.A. USED
Elliott et al (1974)	Oral Surgery	ROUTINELY + I.V. Analgesics or tranquillizers
Shane (1971)	Extractions Short fills	
Recant (1960)	Oral Surgery	LONG CASES To reduce dose of methohexitone
Lyon (1961)		
Green (1963)	General Surgery	
Quinn et al (1973)	General Dental	
Foreman (1967)	General Dental	RESTLESS PATIENTS
Drummond-Jackson (1971d)		To improve working conditions
Kay (1970)	General Dental	KEEP LIGHT LEVELS To maintain cough & swallow reflexes & avoid respiratory depression
Young (1970)		
Bell (1975d)		
Southwell (1976)		
Simpson & Rondeau (1966)	Oral Surgery	Postoperative pain control following extensive surgery

1-11-4c: Complications

Howells (1968) stated that: *When the potential convulsant properties of methohexitone are remembered, its combination with lignocaine demands caution.*

With multiple work there is a chance that the amount of local analgesic injected may be enough to be toxic, or to intensify the depressant action of the sedating agent (Oliver 1974).

Zinman (1976) blames the fatal collapse of two pedodontic patients on the combination of mepivacaine and sedative drugs, due to enhanced respiratory depression. He recommends that no more than 3mg/lb (i.e. 1.3mg/Kg) mepivacaine be used, which is no more than two or three carpules.

Campbell et al (1976) used *Xylocaine* (2% lignocaine) with intravenous fentanyl, diazepam and methohexitone for removal of third molars. One carpule of Xylocaine was used for each third molar, resulting in a total dose range of 80-160mg. No complications were reported.

1-11-4d: Conclusion

1. Supplementation with local analgesics will reduce the incidence of several complications because:
 - (a) Pain stimulus is removed, and
 - (b) Dosage of methohexitone is reduced, and
 - (c) Patients are kept light.
2. With multiple quadrant work, there is a danger of toxicity therefore, no more than 2-3 cartridges of local analgesic should be administered at the one session.

1-11-5: ANTISIALOGOGUES

1-11-5a: Introduction

Methohexitone may produce excessive salivation (Sykes 1969).

This effect could contribute to the cause of laryngeal spasm, hiccough and coughing, reported with its use (see Section 1-7-2).

1-11-5b: Scopolamine

Scopolamine significantly lowers the incidence of such complications, compared to atropine (Dundee et al 1961).

However, scopolamine increases the frequency of spontaneous movements and restlessness, because it is antianalgesic (Dundee & Moore 1961b).

Atropine is more neutral in this effect and produces a lower incidence of these complications with methohexitone (Baron 1964).

Scopolamine will delay recovery because of its sedative effect (Clarke et al 1964).

For these reasons, Dundee (1965d) does not recommend scopolamine - particularly with the M.I.T.

I will thus concentrate the discussion around atropine.

1-11-5c: Action of atropine

The pharmacology of atropine is discussed by Innes & Nickerson (1975).

Atropine is effective within five minutes, lasts for 1-1½ hours (Bennett 1974e), and can be given routinely with methohexitone and other intravenous agents to prevent bradycardia and to minimise salivary secretions (Elliott et al 1974).

Atropine should not be relied upon to prevent laryngeal spasm (Bennett 1974q). Its use may increase the risk of salivary gland

sepsis, sore throat and some patients will complain of dry mouth afterwards (Hudson 1971).

Christenson et al (1961) used hexocyclium methylsulphate instead and have less complaints of postoperative dry mouth.

1-11-5d: Recommended dosages of atropine

Table 11-3 below lists suggested dosages of atropine that should be given intravenously when using methohexitone.

TABLE 11-3: RECOMMENDED DOSAGES OF ATROPINE		
NAME OF STUDY	I.V. DOSE (mg)	COMMENTS
Shafto (1969)	0	
Buxton (1971b)	0.2	Children
Forman (1969)	0.2	Children
Hudson (1965)	0.3	Children
Hudson (1971)	0.3	
Marcy (1974)	0.3	
Wyant & Chang (1959)	0.4	
Buxton (1971a)	0.4	
Elliott et al (1974)	0.4	
Campbell et al (1976)	0.4	
Southwell (1976)	0.4	
Forman (1969)	0.6	(1/100th grain)
Foreman (1970a)	0.6	
Kay (1970)	0.6	
Mann et al (1971)	0.6	
Marcy (1974)	0.6	
Wilkinson et al (1965)	0.6	
Wilkinson et al (1965)	1.2	(1/50th grain)
Thurecht (1973)	1.2	

1-11-5e: Cardiovascular effect of atropine

Increases in heart rates, measured within two minutes of giving atropine (Campbell et al 1976) may last up to 90 minutes (Clarke et al 1964), and are related to a fall in peripheral resistance (Everett & Allen 1970).

The tachycardia produced does not interfere with the circulatory efficiency or the well being of healthy patients (Buxton 1971a).

Elliott et al (1974) and Southwell (1976) did not report tachycardia from atropine, but its use may have protected their patients from a bradycardia (Kay 1970) which could possibly occur with the drug combinations they used.

Wise et al (1969) observed tachycardia with methohexitone alone but not when atropine was also used.

The reduction in peripheral resistance may contraindicate its use in outpatients (Allen 1970; Allen et al 1972; Quinn et al 1973).

Clement & Jenkins (1969) suggest that atropine might offer prophylaxis against arrhythmias which could be caused by strong vagal stimuli from surgery under light anaesthesia (see also Sections 1-7-6 and 1-7-7).

1-11-5f: Effect on respiratory system

Clinical doses of atropine increase depth and rate of respiration by central stimulation (Karliner 1965-6).

1-11-5g: Toxicity of atropine

In the doses commonly used (see Table 11-3), atropine does not cause cortical stimulation (Clarke et al 1964) because it penetrates the blood brain barrier poorly at low concentrations (Innes & Nickerson

1975). Foreman (1967) states: *Atropine is used primarily to produce drying of mucous and salivary secretions rather than a vagal blockade.*

With toxic doses of atropine the central excitation becomes more prominent, and Karlina (1965-6) reports one case of grand mal seizure following intravenous atropine.

1-11-5h: Antanalgesic properties of atropine

A significant, but slight increase in sensitivity to somatic pain following injection of atropine, has been measured by Moore & Dundee (1962).

Thornton (1970) concludes from a review of the literature that because of the known antanalgesic properties of atropine and of methohexitone it is undesirable to use them in combination.

1-11-5i: Contraindications to atropine

This topic is dealt with in Section 1-9-10.

1-11-5j: Mixing atropine & methohexitone in the same syringe

Because atropine is acidic and methohexitone is alkaline, some authors have suggested that they should not be mixed together in the same syringes before injecting (Douglas 1960; Recant 1960; Bennett 1974k).

Weinstock (1960) mixed them together, and Hudson (1965) said that *there is no reason why it should not be given with the methohexitone* and more recently, Hudson (1971) again suggested mixing both together.

1-11-5k: Conclusion

1. The routine use of atropine helps to reduce the risk of laryngeal spasm, coughing and hiccoughing.

2. A dose of 0.6mg for adults will not cause toxic effects.
3. It is not necessary to mix atropine and methohexitone together. Mixing the two may cause changes of potency of either and makes dosage control difficult.

1-11-6: TRANQUILLIZERS, SEDATIVES AND ANALGESICS

1-11-6a: Premedication

Lyon (1961) listed factors affecting the need for premedication:

Age	}	
Weight	}	
Medical history	}	
Apprehension	}	of patient
Physical status	}	
Habits	}	
Length	}	
Difficulty	}	of surgery

Premedication is generally contraindicated for short procedures because of increased recovery time (Hudson 1965), but may be indicated for procedures lasting longer than ten minutes (Weinstock 1960), or where surgery is particularly traumatic (Simpson & Rondeau 1966).

The immediate antanalgesic effect of small doses of methohexitone, observed by Dundee (1964), can be reduced by analgesic premedication (Dundee & Moore 1961c). However, Barron (1964) has shown that some analgesic drugs are also antanalgesic and in fact, cause an increase in side effects.

1-11-6b: Route of administration

Although the oral route may give satisfactory premedication (Foreman 1970a), it has been shown to be less effective than the intramuscular or intravenous routes (Chambiras 1969).

1-11-6c: Drug combinations

Whilst experimentation with combinations of drugs has been criticised (Rees-Jones 1971), the following groups of drugs have been used in combination, and alone, to supplement methohexitone for dental treatment:

1. Major tranquillizers
2. Sedatives and hypnotics
3. Narcotic analgesics and antagonists .
4. Minor tranquillizers.

Table 11-4 below lists those studies which have used a major tranquillizer, hypnotic, narcotic or minor tranquillizer, or combinations of these drugs, sometimes with local analgesia, to supplement methohexitone.

TABLE 11-4: TABLE OF DRUGS AND COMBINATIONS OF DRUGS USED TO SUPPLEMENT METHOHEXITONE					
NAME OF STUDY	MAJOR TRANQUILLIZER	HYPNOTIC	NARCOTIC ANALGESIC OR ANTAGONIST *	MINOR TRANQUILLIZER	L.A.?
Coleman & Green (1960)	promethazine promethazine promethazine promethazine droperidol promethazine				
Lyon (1961)					
Dundee (1965a)					
Rees-Jones (1971)					
Rowlands (1969)					
Robertson (1971)					+
Christenson et al (1961)		quinalbarbitone			
Lyon (1961)		quinalbarbitone			
Myers & Coltman (1961)		quinalbarbitone			
Hubbell (1960)		pentobarbitone			
Hubbell & Royer (1963)		pentobarbitone			
Wyant & Chang (1959)			pethidine		
Hubbell (1960)			pethidine		
Levin (1975)			pethidine		
Dundee (1965a)			an opiate		
Kay (1971)			pentazocine*		
Armstrong (1975)			pentazocine*		

TABLE 11-4 (continued)

NAME OF STUDY	MAJOR TRANQUILLIZER	HYPNOTIC	NARCOTIC ANALGESIC OR ANTAGONIST *	MINOR TRANQUILLIZER	L.A?
Drummond-Jackson (1971d) Thurecht (1973) Quinn et al (1973) Foreman (1968 1970a 1974a) Brett (1971) Buxton (1971b) Litchfield & Gerard (1971) Shane (1971) Levin (1975) Southwell (1976)				oral diazepam oral diazepam oral diazepam I.V. diazepam I.V. diazepam I.V. diazepam I.V. diazepam I.V. diazepam I.V. diazepam I.V. diazepam	
Myers & Coltman (1961) Douglas (1960)	promethazine promethazine	butobarbitone quinalbarbitone			
Dundee (1965a) Silver & Wolpert (1968) Robertson (1971) Robertson (1971) Elliott et al (1974)	promethazine promethazine promethazine promethazine droperidol		an opiate pethidine pethidine pentazocine* fentanyl ± morphine		
Drummond-Jackson (1971d)	perphenazine			meprobamate	

TABLE 11-4 (continued)

NAME OF STUDY	MAJOR TRANQUILLIZER	HYPNOTIC	NARCOTIC ANALGESIC OR ANTAGONIST *	MINOR TRANQUILLIZER	L.A?
Lyon (1961)	promethazine	quinalbarbitone	pethidine		
Doherty (1971)	chlorpromazine		pentazocine*	diazepam	
Howells (1968)		pentobarbitone	pethidine		
Berns (1963)		quinalbarbitone	pethidine		
Adelson (1970)		quinalbarbitone		hydroxyzine	
Adelson (1970)			pethidine	hydroxyzine	
Everett & Allen (1970)			alphaprodine	hydroxyzine	
Shane (1975b)			alphaprodine	hydroxyzine	
Armstrong (1975)			pentazocine*	diazepam	
Horton (1972)			fentanyl	diazepam	
Bennett (1972)			fentanyl	diazepam	+
Campbell et al (1976)			fentanyl	diazepam	+
Brown et al (1968)				diazepam	+
Shepperd & Aust (1968)				diazepam	+

1-11-6d: Major Tranquillizers

1-11-6d(i): Phenothiazine derivatives

These drugs are antihistaminic, anti-emetic, ataractic, sedative and antisialogogue in action (Robertson 1971). In contrast to barbiturates they exert little effect on the cerebral cortex, acting mainly on the reticular activating system (Bennett 1974f).

Less methohexitone is required when supplemented by most phenothiazines (Dundee & Moore 1961c), and both chlorpromazine (Shane 1971) and promethazine (Hubbell & Royer 1963) have produced good operating conditions, despite postoperative nausea and hypotension.

Comparing results of supplementation by phenothiazines to supplementation by diazepam, Shane (1971) observed less amnesia with promethazine, but obtained better operating conditions with chlorpromazine.

Love (1971) has recommended promethazine as premedication for asthmatics because of its bronchodilator action.

Kay (1971) uses large multiple doses of phenothiazines as premedication for handicapped, spastic and nervous patients, but these drugs produce a delayed recovery and are more suitable for inpatient use.

Some phenothiazines are antanalgesic and if used to supplement methohexitone, result in more excitation, more hypotension and less anaesthetic effect (Dundee & Moore 1961a).

In Table 11-4 above, promethazine is shown as the phenothiazine most often used to supplement methohexitone. However, Dundee & Moore

(1961c) have shown that this drug markedly increases the need for increments of methohexitone because of its antanalgesic action. They suggest that phenothiazines are not the best group of drugs to supplement methohexitone with.

1-11-6d(ii): Butyrophenones

These drugs are similar in action to the phenothiazines, and droperidol is the most commonly used drug of this group (Smith & Woolman 1975).

Patients may appear placid, drowsy and indifferent, but in reality they may be agitated and ill at ease (Dundee 1971).

The effect of droperidol may last 24-36 hours, making it unsuitable for ambulant patients (Horton 1972).

Because droperidol is most commonly used in combination with fentanyl, it is discussed further in Section 1-11-6f(v).

1-11-6d(iii): Conclusion

These drugs should not be used on an outpatient basis, particularly because of the danger of hypotension.

1-11-6e: Hypnotics and sedatives

1-11-6e(i): Barbiturates

Despite warnings of misuse and dependency (Kay 1975), which in any case may have been overemphasised (Harvey 1975), short acting barbiturates are recommended as premedication for children (Bennett 1974r) with whom they give better results than diazepam (Hodge 1971).

Jorgensen & Hayden (1972a) prefer barbiturate supplementation to supplementation with major or minor tranquillizers which may produce *sudden unexpected depression of the respiratory centre or an abrupt fall in blood pressure.*

Hubbell & Royer (1963) have managed to complete the treatment, when methohexitone alone has failed, by the addition of 100-200mg pentobarbitone.

The technique described by Berns (1963) is not additive and provides excellent baseline sedation. However, Shane (1975e) found that amnesia was not predictable (see Table 11-4 above).

1-11-6e(ii): Oral barbiturates criticised

Chambiras (1969) tested various drugs for premedication in children and concluded that oral barbiturates are highly inefficient and often the drug would not take effect until after the procedure was complete.

Goulding et al (1957) used butobarbitone but could not distinguish its effects from placebo for premedication.

1-11-6e(iii): Methohexitone premedication

The short action of methohexitone suggests that it might be good preanaesthetic medication for children (Elman & Denson 1965), and would avoid the disadvantages of nausea and hypotension seen with narcotic premedication (Bush et al 1966). In Table 11-5 below I have listed the methods in which methohexitone has been used for premedication.

TABLE 11-5 TABLE OF METHODS OF METHOHEXITONE PREMEDICATION			
NAME OF STUDY	ORAL DOSE	I.M. DOSE	COMMENTS
Coleman & Green (1960)	50mg tablets		Too bulky, bad taste
Bush et al (1961)	Gelatin capsules. 7mg/Kg aqueous drink		Effective in 15-45 minutes. Full recovery in 4 hours. But much variation
Miller et al (1961)		2% saline 6.6mg/Kg (3mg/lb)	Normal saline used to reduce pain. Volume often exceeded 15ml
Dryden & Moshier (1963)		3%	
Elman & Densen (1965)		5% aqueous	Asleep in 2-5 mins. 8.3% could not support own airway
Goldman (1966, 1968)		2%, 6mg/Kg	Asleep in 6 minutes. Recovered 20-30 mins
Rule et al (1967)		2%, 6mg/Kg	
Wilson D.S. (1970)		2%, 6mg/Kg	

Because methohexitone is destroyed by gastric juices (Bailenson 1972b) and by the liver, the amount reaching the brain is quite uncertain when given orally (Breimer 1976).

In 750 children under 15 years of age, Elman & Densen (1965) obtained good results with intramuscular methohexitone, especially for excited or frightened children of 4-5 years.

The disadvantage with intramuscular methohexitone is that strong solutions cause tissue damage and weak solutions must be used in large

volumes for older children (Goldman 1966).

1-11-6e(iv): Conclusions

1. The use of other barbiturates in combination with methohexitone may produce additive effects that are hard to control - particularly if oral premedication is used.
2. Methohexitone has limited use when given either orally or intramuscularly.

1-11-6f: Narcotic analgesics

1-11-6f(i): Rationale

Christenson et al (1961) gave 50-100mg pethidine premedication to patients who had previously been restless on methohexitone alone. Such premedication has been found to reduce the incidence of tremors, involuntary movements and respiratory upset (Dundee et al 1961).

Even when methohexitone has been supplemented with local analgesia, patients may subconsciously misinterpret pressure or touch as being painful and thus become restless (Bennett 1974a).

Narcotic analgesics centrally elevate pain threshold (Bennett 1974h) and it may be possible to dispense with local analgesia - which can sometimes be an advantage (S.A.A.D. Report 1976a).

Chambiras (1969) questions the use of narcotics unless there is severe pain and Robinson (1970) states: *There can . . . be no justification for opiate premedication in general dental practice*, because they produce respiratory depression. Trieger (1976) says that their use is *ill advised* when good local analgesics are available.

These drugs should not be mixed in the same syringe as methohexitone because a precipitation results (Bennett 1974h).

1-11-6f(ii): Morphine

Morphine produces profound analgesia and some sedation lasting 1½-2 hours. Elliott et al (1974) used 0.07mg/Kg (5mg/150lb) to supplement methohexitone and *Innovar* for long outpatient procedures.

I could not find any other references to a similar use, perhaps because morphine causes respiratory depression, postoperative vomiting and is habit forming (Lee & Atkinson 1973a).

1-11-6f(iii): Pethidine (Meperidine)

Pethidine is chemically quite dissimilar to morphine (Jaffe & Martin 1975) but is also a potent analgesic (Jorgensen & Leffingwell 1961; Berns 1963). An average dose will raise the pain threshold by 60-65% (Bennett 1974h).

Dundee & Moore (1961a) used 100mg pethidine to reduce the incidence of spontaneous muscle movements associated with methohexitone.

Berns (1963) uses secobarbitone and pethidine premedication, but even so finds that the M.I.T. is unsuitable for children.

For adult outpatients, previously restless on methohexitone alone, Drummond-Jackson (1971d) gave 10-25mg (intravenously) just before induction.

The maximum recommended intravenous dose is 25mg, but no ampoule of that size is available in Australia (Grainger 1972).

Bennett (1974r) says that pethidine is being used more frequently for outpatients. Quinn et al (1973) say that it is rarely used.

It produces delayed recovery (Foreman 1967) and Robertson (1971) used 25mg pethidine and 25mg promethazine to supplement methohexitone; his patients felt tired all that day.

Pethidine may stimulate the vomiting centre (Jorgensen & Leffingwell 1961) producing postoperative nausea (Hubbell & Royer 1963) and vertigo (Quinn et al 1973). Simpson & Rondeau (1966) recommend the addition of prochlorperazine, 2.5-5mg, to reduce nausea.

When combined with methohexitone, respiratory depression and hypotension can result (Dundee 1963).

Large doses may produce C.N.S. excitation (Jaffe & Martin 1975). Pethidine is addictive and administrations should be left one week apart (Jorgensen & Leffingwell 1961).

1-11-6f(iv): Alphaprodine

Alphaprodine is a congener of pethidine (Kaffe & Martin 1975), but raises pain threshold by 75-100% and is quicker to act and lasts only 45 minutes (Bennett 1974h).

Shane (1971) has used alphaprodine, 30mg, with hydroxyzine, 25mg, to supplement methohexitone. But the amnesia produced is not as good as that produced by diazepam supplementation.

More recently, Shane (1975b) described a technique of conscious sedation using alphaprodine, hydroxyzine, atropine, methohexitone and local analgesia.

Garber (1976) criticises this technique because of the cardiorespiratory changes produced and the delayed recovery.

Tepfer et al (1964) combined alphaprodine with its antagonist, levallorphan tartrate, to supplement a methohexitone drip for lengthy procedures lasting an average of 95 minutes. The average waking time was 12 minutes. The antagonist also helped to reduce the incidence of respiratory depression.

1-11-6f(v): Fentanyl

Fentanyl is related to pethidine but is 1,000 times stronger. Onset of action is rapid and lasts 20-30 minutes. It produces little cortical depression and no cardiac effect; but it does cause respiratory depression and muscle rigidity, reversed by nalorphine (Horton 1972).

Apnoea caused by fentanyl is summarised in Table 7-9, Part L, in Section 1-7-3b(ii).

Bennett (1972) achieved good results for oral surgery with mean doses of: 10mg diazepam, 0.081mg (1.62ml) fentanyl and 58.3mg methohexitone and local analgesia. He noted no respiratory depression and no nausea, and found it preferable to neurolept techniques because recovery was quicker.

Bennett (1974h) states: *My experience with fentanyl has been rather extensive. On no occasion has respiratory depression been encountered using the conservative doses suggested.*

Goroszeniuk et al (1977) report on the use of methohexitone, fentanyl and nitrous oxide for 70 short surgical procedures. Prior

administration of fentanyl (0.075-0.15mg) abolished muscle movements, whilst recovery times were apparently reduced. They found no evidence of muscle rigidity and the incidence of apnoea was 14%.

The mixture of fentanyl with the major tranquillizer, droperidol, called *Innovar*, is a neuroleptanalgesic and has been used with methohexitone (Elliott et al 1974). But the technique is limited because of prolonged recovery (Shane 1975f).

1-11-6f(vi): Conclusions

These drugs are unsuitable for outpatient use because of respiratory depression, delayed recovery and hypotension.

1-11-6g: Narcotic antagonists

1-11-6g(i): Pentazocine

Pentazocine is one of the many compounds synthesized as part of a deliberate effort to develop an effective analgesic with little or no abuse potential (Jaffe & Martin 1975).

Pentazocine is preferable to other analgesic drugs as there are no basic physiological changes produced with its use (Armstrong 1974). Grainger (1972) observed no clinical side effects in more than 150 cases in which 30mg pentazocine was given.

For short surgical or conservative cases, Armstrong (1975) reduced the methohexitone dosage by half, by first giving 15-30mg pentazocine, in 363 cases. However, in 26 cases, there was noticeable respiratory depression.

He says that for longer cases, the combined use of pentazocine,

diazepam and methohexitone has supplanted the Jorgensen technique. However, in 710 cases, he had six cases of *respiratory embarrassment* with the combination.

Grainger (1973) says that the respiratory depression produced by pentazocine is dose related; but it is a safer drug than pethidine in this respect. He studied the effects of diazepam (up to 20mg), and pentazocine (30mg) on 50 apprehensive patients. No methohexitone was given and no respiratory depression was observed.

Pentazocine can produce postoperative nausea and Kurland (1968, 1971) gives cyclizine (50mg) with the pentazocine to prevent this complication.

Disturbed recoveries, with hallucinations and bad dreams, are side effects where prolonged administration and high dosage have occurred (Main 1975).

Kurland (1968) gives methylphenidate to aid recovery, but Franz (1975c) is not convinced of the effectiveness of this stimulant as an aid to treatment of overdosage of depressant drugs.

Pentazocine should be avoided in pregnancy and is not recommended for children under twelve (S.A.A.D. Report 1976a).

1-11-6g(ii): Conclusion

Pentazocine will cause respiratory depression when used in combination with methohexitone.

1-11-6h: Minor tranquillizers

1-11-6h(i): Diazepam - Properties

Diazepam has been used in dentistry since 1964, initially as an

oral premedicant, then intravenously for mainly uncooperative patients. Good reports have been made from the supplementation of methohexitone with diazepam (Litchfield & Gerard 1971).

On injection, a relaxed sedation and slight nystagmus is produced within one minute and lasts 45 minutes (Foreman 1969d).

Diazepam acts mainly on the limbic system without significant respiratory, autonomic or extrapyramidal activity (Foreman 1974a).

Its main advantages are its absence of cardiovascular effects and intense amnesia (Brown & Dundee 1968), and its muscle relaxing effects which considerably diminish the gag reflex (Litchfield & Gerard 1971).

1-11-6h(ii): Diazepam - Dosage

A dosage within the range 5-15mg produces good baseline sedation (Foreman 1969d; Chambiras 1970c), with an average dose being 10mg (Hudson 1971). There is no need to take patients as deep as the Verrill sign (Trieger 1976).

1-11-6h(iii): Physiological effects of diazepam

Diazepam can produce mild respiratory and cardiovascular depression but these are minimal (Litchfield & Gerard 1971). Main (1975) found *no alteration in cardiorespiratory function or E.C.G. waveform* with diazepam and pentazocine together.

Southwell (1976) used diazepam and methohexitone together and noted that diazepam produced peripheral vasodilatation and a decrease in blood pressure by as much as 30mm Hg in some patients.

If injected quickly, diazepam will produce bradycardia and hypotension. Quinn et al (1973) recommend a rate of 2.5mg/30 seconds, and Foreman (1969d) suggested 2mg/minute.

1-11-6h(iv): Diazepam for children

Diazepam has had disappointing results with children (Brown et al 1968). Main (1971) suggests dosages for oral premedication in children from 5mg to 10mg, depending on age.

1-11-6h(v): Foreman's technique of supplementation with diazepam

Diazepam potentiates methohexitone (Woods 1974) and the combination has been used by Hudson (1975) for seven years with safety.

Diazepam produces a baseline sedation and increments of methohexitone are added to reinforce amnesia, as well as to deepen sedation when required (Foreman et al 1968).

This technique has been found the most preferable for long appointments (Brett 1971). Foreman (1971) has found that 10-20mg followed by 100mg methohexitone, given in 5-10mg increments, and local analgesia, is sufficient for cases taking up to two hours.

1-11-6h(vi): Litchfield's technique of supplementation

Foreman (1974a) prefers increments of methohexitone rather than further increments of diazepam, because methohexitone is more reliable, gives profound amnesia and a quicker recovery.

However, Litchfield (1975a) states: *In view of concern raised as to the safety of using large doses of methohexitone sodium intermittently, the author decided to rely primarily on diazepam to maintain deep sedation . . . rather than increase the increments of methohexitone sodium.*

When used together, dosage of methohexitone becomes less and the relaxing properties of diazepam produce better working conditions

(Litchfield & Gerard 1971).

1-11-6h(vii): Diazepam produces better working conditions on restless patients

Foreman et al (1968) obtained much better working conditions in 18 out of 24 patients who were previously restless on methohexitone alone.

With such patients, Drummond-Jackson (1971d) found that as little as 5mg diazepam *may effect a virtual transformation in providing relaxation and quiet working conditions.*

Litchfield & Gerard (1971) were able to increase their average of 87% good working conditions under diazepam alone, to 100% good working conditions when methohexitone was also given.

Kurer (1975) was . . . *most impressed with the results of adding 5-10mg diazepam immediately before induction with methohexitone, in patients known to be restless with methohexitone alone.*

(Restlessness is discussed in Sections 1-5-8b and 1-9-2f.)

1-11-6h(viii): Use of diazepam to reduce dose of methohexitone

In Table 11-5 are listed some methods used to treat patients for long sessions.

TABLE 11-5: METHOHEXITONE AND DIAZEPAM TECHNIQUES	
NAME OF STUDY	METHOD USED
Foreman et al (1968)	methohexitone, diazepam & L.A.
Young (1970)	methohexitone, diazepam & L.A.
Brett (1971)	methohexitone, diazepam & L.A.
Litchfield & Gerard (1971)	methohexitone, diazepam & L.A.
Foreman (1974a)	methohexitone, diazepam & L.A.
Shane (1975d)	methohexitone, diazepam
Southwell (1975)	methohexitone, diazepam & R.A.
Southwell (1976)	methohexitone, diazepam, L.A. & R.A.

Southwell (1975) averaged 75 minutes treatment time and the average maximum dose of methohexitone was 135mg and maximum dose of diazepam was 17mg. Southwell (1976) extended operating time up to 130 minutes, but never gave more than 200mg methohexitone.

Foreman et al (1968) prefer the Jorgensen technique if treatment is expected to be more than two hours.

1-11-6h(ix): Dangers of diazepam supplementation

Brett (1971) gives nervous patients an initial straight induction of methohexitone to relax them before giving diazepam. In one of the techniques, described by Thurecht (1973), he gives 20-30mg methohexitone first then diazepam to ptosis.

Following the death reported by Drummond-Jackson (1974), the combination of diazepam and methohexitone was questioned, particularly the administration of diazepam after methohexitone (Death 1975).

Allen et al (1976) warn of the additive effects of diazepam and methohexitone combinations causing a reduction in total peripheral

resistance.

Foreman (1969d) suggests that this combination be restricted to experienced operators only because of the increased danger of overdose.

Because of this potentiation effect, Baer (1971) suggests that the induction dose of methohexitone be reduced to 20-60mg of methohexitone, and increments need be given less frequently, say every 12-15 minutes.

Because of circulatory depression produced by the combination, patients should be kept supine for one hour (Foreman 1969d).

1-11-6h(x): Minor tranquillizers continued

(1) Hydroxyzine

Hydroxyzine produces sedation, bronchodilation and is antisialagogue, anti-emetic, anti-arrhythmic and ataractic. It produces minimal circulatory and respiratory depression (Smith & Wollman 1975).

It is used in the Shane (1966, 1971, 1975b) technique, prior to giving methohexitone.

The combination has been criticised because sudden unexpected respiratory depression and drops in blood pressure have been noted (Jorgensen & Hayden 1972a; Garber 1976).

Hydroxyzine has been withdrawn as an intravenous agent because of reports of endarteritis, thrombosis and digital gangrene (Bailenson 1972a).

(2) Methylpentynol

This drug has been used by Goulding et al (1957) in combination

with butobarbitone and chlorpromazine as premedication with poor results.

(3) Meprobamate

This drug was used by Drummond-Jackson (1971d) with perphenazine as oral premedication.

1-11-7: CONCLUSIONS

1. Small quantities of diazepam (5-10mg), prior to methohexitone, may help to reduce total methohexitone dosage without greatly altering the physiological status of the patient.
2. The use of sedatives and analgesics to supplement methohexitone is contraindicated in outpatient dentistry because of delayed recovery, hypotension and respiratory depression.
3. Atropine will help to reduce the incidence of laryngeal spasm and coughing.
4. There is much justification for the use of local analgesics (see Section 1-11-4d).
5. Low concentrations of nitrous oxide may help to reduce restlessness, jactitations and dosage of methohexitone.
6. Increased concentrations of oxygen, through a nosepiece, will help to reduce the risk of hypoxia.

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1-12-1: INTRODUCTION

In this section I have reviewed:

1. The types of tests that have been used to assess recovery from methohexitone.
2. The effect on recovery of various variables.
3. Case reports of delayed recovery.
4. Weeping on recovery.
5. Drugs used to hasten recovery.

At the end, I have made some general conclusions. Conclusions have also been made at the end of several individual parts where I thought comments were necessary.

1-12-2: MEASUREMENT OF RECOVERY

1-12-2a: Introduction

When methohexitone was first introduced, it was thought very suitable for outpatient anaesthesia because patients seemed to recover very quickly (see Sections 1-1-6, 1-1-7).

Wyant et al (1957) commented: *The smooth awakening and the absence of hangover which were noted in the experimental work have been confirmed in clinical practice.*

The importance of the study of recovery in outpatient dental anaesthesia and sedation is contained in a statement by Doeniche (1965). *It should be stressed again that in intravenous anaesthesia in our patients the duration of after-effects, such as tiredness, hang-over and intermittent sleep stages, is of great importance, since these effects limit the activity of the patient and his ability to manage traffic.*

Recovery consists of two states:

1. Recovery from unconsciousness.
2. Recovery from all narcotic influence (Howells 1968).

1-12-1b: Recovery tests

To assist in assessing recovery, various tests have been devised which are claimed to be able to give a more precise indication than observation alone.

Carson (1975) reviewed the literature. Basically, two types of observation can be recorded:

1. Behavioural response threshold to various psychodiagnostic tests at specific recovery stages.
2. Measurement of altered physiological factors which return to normal following anaesthesia, for example, E.E.G. patterns.

1-12-2c: Tests measuring return of altered physiological factors

Drummond-Jackson (1960) used such an observation when he first began studying methohexitone. He noted that: *The duration of threshold anaesthesia was gauged by return of the lash reflex or by reaction to painful stimulus.*

He also observed how the patients coped with walking unaided.

Green & Jolly (1960) also assessed complete recovery on coordinated gait, and on the return of clear, normal speech, and when the patient felt the absence of hangover (i.e. no dizziness and a clear head).

Young & Whitwam (1964b) divide recovery into three stages:

1. The waking time: when the patient can talk coherently.
2. The walking time: when the patient can walk to the recovery room.
3. The steady or recovery time: when the patient can leave accompanied by an adult.

They assess the latter by the *Romberg Test*. That is when the patient can stand erect with no swaying when eyes are closed and feet are together.

Bender's Face Hand Test was *the most objective test found* by Heaton (1956) for judging recovery from methohexitone compared to thio-pentone. As soon as possible after surgery, the patient is asked to close his eyes. The surgeon then touches the patient's cheek and contralateral palm briefly, but firmly, with two fingers simultaneously. When both stimuli were perceived correctly within a few seconds, after three successive testings, recovery was considered to have occurred.

Vickers (1965) attempted to apply established tests of central nervous system coordination during recovery from methohexitone. Successful tests included a peg board test, and a flicker fusion threshold which measures changes in function of the cerebral cortex.

The eye was also used by Kurland (1967). Firstly, he measured reaction to eyelid stimulation; he also measured the time taken for recovery from jerk nystagmus, that is when the patient was able to focus on a moving object (the operator's finger) without any trace of jerkiness in the movement of the eyes.

Hannington-Kiff (1972b) has developed a test which measures the relative position of the eyeballs with a modified Maddox-Wing; the test relates to the double vision effect of intoxication. He had intended to produce this device commercially, but I have not seen any further reference to it.

1-12-2d: Tests measuring altered psychological factors

Fatigue and depressant drugs tend to exaggerate any psychomotor dysfunction. Such dysfunction can be measured by the Bender Motor Gestalt Test.

The test has been modified to assess recovery from anaesthesia and sedation by Trieger et al (1969), Newman et al (1969) and Newman et al (1970).

Egbert et al (1959) used a complex driving reaction timer, obtained from the American Automobile Association, which measures the ability to drive a car, quantitatively.

Elliott et al (1962) and Green et al (1963) used a Miles Trainer driving apparatus to assess recovery from methohexitone. The task consisted of *driving* a *car* along a rather winding road at dusk.

Wilkinson (1965) assessed the recovery from methohexitone using a *driving simulator*. Volunteers were given the same tests as suspect drunken drivers are given, and assessed by the New Zealand police.

Korttila et al (1975) also used a driving simulator to assess and compare recovery from thiopentone, methohexitone and alphadione.

Return of normal E.E.G. patterns was used by Doeniche et al (1966) to assess potentiation of alcohol by methohexitone.

1-12-2e: Criticism of tests

Vickers (1965) says that tests which determine the earliest response to stimuli (e.g. ability to open eyes, to sit up, to walk, etc.) are not adequate guides to the patient's ability to react safely to the environment.

He also feels that the simulated driving tests are difficult to quantify the impairment, and in any case, are unsuitable for routine use.

Elliott et al (1962) found that there was no deterioration in driving performance in the absence of clinical symptoms: *Clinical assessment is an adequate guide to recovery.*

Young (1974) decided recovery by clinical assessment alone. Because his patients were always accompanied home by an adult, judgement of *exact degree of recovery is unnecessary.*

Recant (1960) did not think the various tests are significant for ambulatory anaesthesia, because of the possibility of a secondary depression.

Because of the rapid redistribution of the drug, rather than detoxification, clinical recovery observed after low doses of methohexitone is more apparent than real (Foreman 1970a).

Foreman (1974a) treated 30 adults for general dentistry under methohexitone (average 80mg), diazepam (average 19mg) and local analgesia. All patients were fully ambulatory at the conclusion of treatment (average 81 minutes treatment) and were Romberg steady (see Table 12-4).

All showed a return to normal base line drawings of the modified Bender Motor Gestalt Test. *Although all had appeared deceptively wide awake and alert on leaving the office - on follow up, 19 patients said that they had felt tired and slept for up to two hours after returning home.*

Everett & Allen (1970) gave 9 healthy males alphaprodine (30mg), hydroxyzine (25mg), scopolamine (0.4mg), local analgesia and methohexitone (20mg). 45 minutes postoperatively, despite two positive Bender face hand tests, maximum cardiac depression was still present (21% below control).

E.E.G. tests demonstrate reduced fitness for as long as eight hours after barbiturate anaesthesia (Carson 1975). The main disadvantage with E.E.G. tests is the need for an expert to interpret the tracing.

1-12-2f: Conclusions on recovery tests

1. The special recovery tests are difficult to use in a clinical situation.
2. An experienced operator should be able to assess when a patient has recovered sufficiently to be taken home.
3. Patients who have apparently recovered need to rest for several hours at home.
4. There is very little quantitative information available on recovery times (see Tables 12-1, 12-2, 12-3, 12-4).

It would appear however, that most patients are sufficiently recovered 30 minutes after treatment, to go home.

1-12-3: RECOVERY VARIABLES

Galley (1966) lists causes of delayed recovery from dental anaesthesia:

1. Length of anaesthesia
2. Depth of anaesthesia
3. Hypoxia

4. Hypotensive episodes
5. Subclinical epilepsy
6. Hypoglycaemia
7. Hyperglycaemia
8. Lack of food
9. Lack of sleep
10. Cerebral episodes including hypersensitive encephalopathy
11. Coronary occlusion
12. All other known causes of syncope

Some of these factors will be discussed below, if pertinent to the use of methohexitone in outpatient dental surgery.

1-12-4: EFFECT OF DOSAGE

1-12-4a: Observations

Wyant et al (1957) noted that even after repeated injections of methohexitone, recovery was prompt.

However, Egbert et al (1959) found that if the dosage of methohexitone was doubled, so was recovery time. Elliott et al (1962) agreed with this observation, but they suggested that large doses should not be used on outpatients. Thus, within reasonable limits, they state: *We are confident that the dose could be increased without delaying recovery unduly.*

Hutchinson & McNeill (1963) noted that after an average total dose of 113.2mg methohexitone, 94% of patients were awake within five minutes. But three patients who received an average total dose of 240mg took 7, 13 and 20 minutes respectively till they were awake.

Although, Young (1974) says that recovery time cannot be related

TABLE 12-1: RECOVERY - METHOHEXITONE AS SOLE DRUG

NAME OF STUDY	NO.	TYPE	DOSE (mean) mg	LENGTH (mean) mins	WAKE (mean) mins	WALK (mean) mins	STEADY (mean) mins	COMMENTS
Egbert et al (1959)	14	None	92	2.98	?	?	14.23	Adults: Did driving test. If double dose, recovery doubles
Drummond-Jackson (1960)	200	None	80	2.0	?	4	?	2 took more than 8 mins to pass a walk test
Elliott et al (1962) Green et al (1963)	20	None	0.88mg/Kg	2.38	?	5	35.0	Drive test only. 75% steady at 35 mins.
Foreman (1965)	100	DG	60-100 + incr	?	30 sec (77%)	30 sec (60%)	?	
Vickers (1965)	5	None	1mg/Kg	?	?	?	30-60	Various tests
		None	2mg/Kg	?	?	?	45-90	
Finch & De Kornfeld (1967)	24	None	50	2.5 (only 1 asleep)	3	3	?	Males. Only one went to sleep
	25	None	50	0.9	1.44	4.4	?	Females. Sitting test
	26	None	75	1.0	1.36	3	?	Males. Only 19 slept
	24	None	75	2.45	3	5	?	Females

TABLE 12-1 (continued)

NAME OF STUDY	NO.	TYPE	DOSE (mean) mg	LENGTH (mean) mins	WAKE (mean) mins	WALK (mean) mins	STEADY (mean) mins	COMMENTS
Wise et al (1969)	30	DG	460	74	?	?	?	Some severe post op. hypotension
Shafto (1969)	500	DE	45-170	4 or less (84.6%)	?	?	10-20	Children
Ryder (1970)	28	DE	30-160	?	1.38	?	?	Children
Korttila et al (1975)	10	None	2mg/Kg	5	?	6.6		50% still tired after 8 hours
Male & Allen (1977)	48	None	80-500	≤ 60	≤ 5	?	?	E.E.G. study of epileptics

1-12-4c: Discussion: Methohexitone as sole drug

Table 12-1 above shows:

1. The variety and paucity of available information.
2. Where no work is performed: 50mg methohexitone may not produce unconsciousness, and as much as 2mg/Kg will produce 5 minutes unconsciousness.
3. Waking time is rapid (30 seconds to 3 minutes), but is slower in females.
4. Patients are able to walk almost immediately, and up 6.6 minutes after awakening.
5. Patients are usually sufficiently recovered to go home from 14.23 minutes to 90 minutes postoperatively.

1-12-4d: Conclusions: Methohexitone sole drug

1. See Section 1-12-4c.
2. See Section 1-12-16.

1-12-5: EFFECT OF NITROUS OXIDE

1-12-5a: Observations

Forman (1971) has used methohexitone for induction only followed by 80% nitrous oxide, for 20 minute conservative cases. With this technique, very little methohexitone is used and as a result, he has never needed to use a recovery room. (Unfortunately further details are unavailable.)

Young (1974) can relate recovery time to dose expressed as mg/Kg when methohexitone is followed by nitrous oxide and oxygen. Recovery is more prompt the more reliance is placed on nitrous oxide and oxygen for maintenance. In this way, cumulative effects of methohexitone are reduced.

1-12-5b: Recovery figures: with nitrous oxide

In Table 12-2 below, the following abbreviations have been used:

NO	Number of patients
TYPE	Type of treatment:
	DG = general dental
	DE = extraction, oral surgery
	GG = gynaecology
DOSE	Percentage of nitrous oxide (in parenthesis)
LENGTH	Length of treatment in minutes or duration of unconsciousness if no treatment
WAKE	Waking time in minutes = time from completion of surgery till can open eyes by command
WALK	Walking time in minutes
STEADY	Steady or recovery time in minutes

TABLE 12-1: RECOVERY - METHOHEXITONE WITH NITROUS OXIDE AND OXYGEN									
NAME OF STUDY	NO.	TYPE	DOSE (mean) mg	LENGTH (mean) mins	WAKE (mean) mins	WALK (mean) mins	STEADY (mean) mins	COMMENTS	
Redish et al (1958)	16	DE	134 (75%)	?	5.1	26.8	37.2	Romberg test	
Green & Jolly (1960)	500	DE	0.7mg/Kg (85%)	?	?	6 (91%)	30 (94%)	15 had inhalation supplements	
Jolly (1960)	35	GG	100-260 (75%)	7.33	8.3	?	?	papaveretum premedication. Females	
Swerdlow (1962)	200	DE	0.94mg/Kg (75%)	?	1.5 (max)	?	24.9		
Wilkinson et al (1965)	6704	DG	80-120 (80%)	90 (max)	?	5-10	20-30	Many did not have nitrous oxide	

1-12-5c: Discussion: Effect of nitrous oxide

From the figures in Table 12-2, it would appear that nitrous oxide allows longer working time without increasing recovery time. However, the information is incomplete.

1-12-5d: Effect of nitrous oxide and halothane

In Table 12-3 below, similar abbreviations have been used as in Tables 12-1 and 12-2.

TABLE 12-3: RECOVERY - METHOHEXITONE, NITROUS OXIDE, HALOTHANE								
NAME OF STUDY	NO.	TYPE	DOSE (mean) mg	LENGTH (mean) mins	WAKE (mean) mins	WALK (mean) mins	STEADY (mean) mins	COMMENTS
Goldman & Kennedy (1964)	298	DE	290 (70-80%)	20 (max)	?	3 (90%)	15-20 (20-30 with 5% metho.)	Recovery varied as appointment length
Young & Whitwam (1964b)	2000	DE	136 men 70.4 women (80-90) 30% halo.	28 (max)	?	?	30 (97%)	40 min. max. recovery
Hellewell & Hutton (1967)	122	DE	80 (74) 30% halo.	10 (max)	?	?	30	
Andrew et al (1973)	68	DE	2mg/Kg (70) some halothane	1.9 (no hal) 3.93 (hal)	2.66		20-40	

1-12-5e: Discussion: Effect of Nitrous Oxide & Halothane

Most patients were able to leave the surgery in under thirty minutes. Unfortunately, all cases were for extractions - therefore working times were short.

1-12-6: EFFECT OF PREMEDICATION

1-12-6a: Observations

Berns (1963) used quinalbarbitone (secobarbital) and pethidine (meperidine) as premedication prior to incremental methohexitone. Even with very short procedures, a euphoria persists for several hours.

Newman et al (1970) gave one group of oral surgery patients an average of 38.2mg pethidine (meperidine) and 53.5mg hydroxyzine and 132.2mg methohexitone. Full recovery, as measured by the Bender Motor Gestalt Test, did not occur for 80 minutes.

Kurland (1971) has found that the usual dosage of methohexitone can be reduced to one quarter or one third if pentazocine (20-30mg) is used as premedication. Conservation appointments of up to 60 minutes require only seven minutes recovery to walking time.

Elliott et al (1974) used Innovar, or morphine or fentanyl as premedication prior to incremental methohexitone and local analgesia for oral surgery. Duration of surgery was from 5 minutes to four and one half hours. Delayed recovery could be related to dosage of Innovar used; but if the Innovar was kept under 2ml, then patients usually recovered and were ready to leave in ten minutes.

Campbell et al (1976) found that recovery was not prolonged beyond 30-45 minutes after completion of surgery (of 30-45 minutes

length) despite using fentanyl (0.1ml) and diazepam (15mg) as premedication.

Litchfield (1974) used high dosages of diazepam in his study with handicapped children, and did not report any delayed recovery.

Southwell (1975) conducted a survey of a small number of patients in his practice. For an average operating time of 75 minutes, average recovery was 11.5 minutes, and maximum recovery was 30 minutes. Drugs used were, diazepam (17mg) and methohexitone (135mg).

Southwell (1976) used the combination: relative analgesia, diazepam (up to 20mg), local analgesia and methohexitone (up to 200mg). The maximum recovery time recorded was 30 minutes, and maximum operating time was 130 minutes.

1-12-6b: Recovery figures: with premedication

In Table 12-4 below, the abbreviations used are the same as in the preceding three tables with the following additions:

TYPE OF TREATMENT: GS = general surgery (brief)

GM = major surgery

GT = tonsillectomy

The additional drugs used have been placed in the comments column. The DOSE column refers to methohexitone only.

TABLE 12-4: RECOVERY - METHOHEXITONE + PREMEDICATION

NAME OF STUDY	NO.	TYPE	DOSE (mean) mg	LENGTH (mean) mins	WAKE (mean) mins	WALK (mean) mins	STEADY (mean) mins	COMMENTS
Wyant & Chang (1959)	66	GG	324.8	15.57	13	?	?	Pethidine 50mg
Douglas (1960)	95	DG	30-250 (80)	3 hrs max	?	15	30	Promethazine Quinalbarbitone
Christensen et al (1961)	127 (admins)	DE	262	19	3 (87%)	3 (57%)	?	Pethidine Quinalbarbitone
Lyon (1961)	513	DE	20-500 (50-85)	15.08	85-9 secs			Pethidine 15-25mg & others
Myers & Coltman (1961)	1500	DE	100	43	30 sec	?	30	Promethazine Butobarbitone some trichlor- ethylene
Hutchinson & McNeill (1963)	50	GS	113.2	5.7	5 (94%)	?	?	Morphine or pethidine. 23 went back sleep
Green (1963)	81	GM	220-1250	up to 3.5 hrs	8.7	?	?	In only 3 did wake time exceed 15min extradural block. LA used too
Liscombe (1968)	30	GT	110-390	12-29	8	?	?	Trimeprazine or pethidine
Foreman (1974a)	30	DG	81	81	all at end of work			Diazepam 19mg LA. 19 felt tired after

1-12-6c: Discussion: Effect of premedication

1. Pethidine increases recovery time.
2. Pentazocine reduces recovery time.
3. *Innovar* increases recovery time.
4. Diazepam does not increase recovery time - for long cases.
5. Detailed information is not readily available (see Table 12-4).
6. It is interesting that in the study by Green (1963) where up to 1250mg methohexitone was given for major surgery for up to 3.5 hours, no waking time exceeded 15 minutes and the mean waking time was 8.7 minutes.
7. Recovery times, where available, do not seem much different than the other tables.

1-12-7: EFFECT OF TREATMENT TIME

This leads on of course from dosage, particularly with the M.I.T. Hubbell (1960) recorded only slightly longer recovery times for longer cases where relatively larger doses were used.

Tepfer et al (1964) used a 0.2% methohexitone drip and nitrous oxide and oxygen for head and neck surgery. The patients were premedicated with alphaprodine and lclallorphan tartrate. The longest treatment was 8 hours and 15 minutes. The patient was awake in 40 minutes.

Green (1963) used a 0.1 or 0.2% methohexitone drip, together with local analgesia for major surgery. He found evidence of some cumulation, but mean recovery was 8.7 minutes after the drip was stopped (see

Table 12-1 above).

Young (1970) found that recovery time was usually one quarter operating time for patients receiving methohexitone only.

1-12-8: EFFECT OF SURGICAL STIMULATION

Drummond-Jackson (1960) observed that the stimulus of surgery will speed up recovery.

Studies in which no surgery was carried out, but in which the patient was just allowed to wake up, should show longer recovery times. If one looks at the *methohexitone alone* table (see Table 12-1) then it is the case. (Compare Shafto (1969) to Vickers (1965).)

1-12-9: EFFECT OF METABOLISM

Kurland (1967) found that if patients were first induced with 300mg propanidid and then maintained on methohexitone (to 30mg), recovery time was halved. This technique relies on the rapid destruction of propanidid.

There will always be some patients who metabolise methohexitone slowly for a variety of reasons and these patients will demonstrate a delayed recovery (Trieger 1976).

To recirculate stored diazepam from the dependent *depot* areas (e.g. legs) and thus avoid periods of renewed sedation with diazepam after apparent recovery, Hannington-Kiff (1972b) suggests giving these patients a short period of exercise before they leave the surgery. In view of possible orthostatic hypotension, I think this practice is questionable.

1-12-10: EFFECT OF SUBCLINICAL EPILEPSY

Male & Allen (1977) report on methohexitone in 48 epileptic patients. They comment: *Delayed or incomplete recovery from methohexitone anaesthesia could be attributed to petit mal epilepsy; petit mal status could only be confirmed by an E.E.G. recording which may not be readily available.* (Epilepsy is discussed in Section 1-9-4.)

1-12-11: EFFECT OF ANOXIA

Delayed recovery can be caused by cerebral hypoxia of two minutes duration. Even in less severe cases, the brain may have received permanent neuronal damage (Bourne 1957).

Even a brief delay in recovery (say 30 minutes) after a stagnant anoxia episode, with an apparently normal return to consciousness, must cause some permanent brain damage (Bourne 1967j).

This could occur in patients who develop hypotension on recovery or during treatment (Trieger 1976) and such orthostatic hypotension in the presence of apparent recovery has been described by Wise et al (1969); and the loss of memory subsequent to methohexitone, by Blaaberg (1966).

Penman (1968) allowed his patients to stand up as soon as they had appeared to recover from minor treatment under methohexitone. An infrequent, but steadily recurrent complaint at follow up, was impaired memory. He changed his technique and keeps patients supine and gradually raises them from horizontal to upright over a period of five minutes.

He comments: . . . *I have a strong impression that the new*

routine has much reduced the incidence and severity of memory impairment. Unfortunately, there are no further details.

The psychiatrists, Friedman & Silverstone (1968) used methohexitone on 4,000 occasions and found no loss of memory (see also Section 1-7-5c).

1-12-12: DELAYED RECOVERY - CASE REPORTS

The S.A.A.D. Survey (Drummond-Jackson 1971d) reported an incidence of 0.177% recovery prolonged over one hour, and dissociation over two hours of 0.001%. One can only speculate on the cause.

Green & Jolly (1960) used methohexitone in 500 administrations for outpatient dental extractions. Only one case of delayed recovery was reported: A patient, . . . *refused to stand on her feet* for 60 minutes before she could be escorted home.

Galley (1966) describes a case where lack of sleep was the single causative factor. A nurse took 24 hours to fully regain consciousness, her E.E.G. was normal. The only possible cause for the delay was thought to be the fact that she had slept for only 13 hours in the five days previously.

Wilson, C. (1970) gave an adult female atropine, 140mg methohexitone, I.A., over ten minutes at noon. By 4.00 p.m. recovery was not complete, so she was hospitalised and subsequently discharged at 8.00 p.m. She felt sleepy next day and took a week off work, and still felt sleepy one week later. The patient, a nurse of the practice, normally took *Nardil* (phenelzine sulphate), *Librium* (chlordiazepoxide), and was also taking penicillin and aspirin at the time of treatment.

A synergistic effect of atropine and *Nardil* (a M.A.O.I.) was suspected and confirmed when the patient rapidly responded to treatment with neostigmine.

Kurer (1975) describes one case of delayed recovery which occurred with a healthy female patient who had attended for three previous treatments uneventfully. Sixteen minutes after the start of conservation, with incremental methohexitone, the patient's condition deteriorated, with no palpable pulse and arrested respiration.

The patient was hospitalised and treated with hydrocortisone and adrenaline, and recovered consciousness with no known sequelae.

1-12-13: WEeping ON RECOVERY

1-12-13a: Incidence

Wilkinson & Wilkinson (1960) induced 98 patients prior to nitrous oxide and oxygen, with methohexitone for extractions. Weeping and depression were the most common complications and occurred in 16 females (16.3%) and one male (1%).

Hubbell (1960) achieved a similar incidence of 15% following oral surgery. Hellewell & Hutton (1967) induced 122 patients for extractions, with methohexitone prior to nitrous oxide and oxygen maintenance; on recovery, 8 cases of excitement and 7 cases of crying were recorded.

Shafto (1969) had 4 children with severe postoperative excitement, one with postoperative mania, but he did not record the incidence of simple weeping.

Hubbell & Royer (1963) note that this is usually transitory and no treatment is necessary, although they do discuss a further complication, *postanaesthesia anxiety*, in which the patient complains of inordinate amounts of pain for 36-48 hours afterwards. They recommend an outline

of treatment.

Young & Whitwam (1966) gave 4,000 administrations of methohexitone for general dental treatment and the incidence of postoperative crying was 10%. Of these, 90% were female.

In the S.A.A.D. Survey (Drummond-Jackson 1971d) of incremental methohexitone for general dental treatment, an incidence of 0.009% was recorded for uncontrolled weeping on recovery.

Grainger (1970a) reported 2 cases of weeping out of 20 cases of methohexitone for extractions (10%).

1-12-13b: Cause of weeping

It appears unrelated to preoperative assessment (Young & Whitwam 1969b). Weeping could be caused by reception of pain at a light level of consciousness (Bourne 1967c).

Andrew et al (1973) induced 68 children with methohexitone prior to nitrous oxide and oxygen for extractions. On recovery, 10 cried (14.7%). Some children received halothane and the incidence of crying was less.

It is natural for children to wake up crying in any case (Hubbell 1960).

O'Brien (1972) states that: *In general, patients who are very nervous tend to be restless during recovery . . .* He suggests the use of an analgesic.

Foreman (1967) says that the minimal incremental technique attracts patients of a highly emotional disposition who may not have

been treated for many years, and an underlying stress may be present. Thus mental depression and hysteria on recovery can be expected.

Perhaps a deep personal worry comes to the surface unchecked under the relaxation of recovery (Drummond-Jackson 1971c).

Mann et al (1971) asked 357 patients how they felt after receiving minimal incremental methohexitone for conservative dentistry. Two said they felt depressed for the whole day.

Elliott et al (1974) premedicated 88 patients with Innovar, fentanyl and local analgesia prior to methohexitone for oral surgery. They noticed *postoperative nervousness*, usually 4-8 hours later. They thought that the droperidol in the *Innovar* was to blame. Diazepam was prescribed.

Bourne (1967c) feels that postoperative weeping can be due to a personal idiosyncrasy and he has observed that a patient who weeps once will weep again.

However, Foreman (1967) has not found this to be the case. Once the patient is over his initial apprehensiveness, he will not react this way again.

Grainger (1970a) reports one patient who wept, who did not weep previously. Treatment was similar.

1-12-13c: Conclusions on weeping

1. The incidence of weeping after methohexitone is higher in women (10-15%) than men (1%).
2. The incidence in children varies from none to 14%.

3. It is difficult to correlate the incidence of weeping to pain or to psychological factors. Probably all play a part.
4. Patients who weep once may weep again next time.

1-12-14: SHOULD PATIENTS BE ESCORTED HOME?

Foreman (1967) does not insist on patients being accompanied home following treatment with the M.I.T., but they must remain on the premises for at least half an hour.

Sara (1974) said: *It can be truthfully stated that there are many admission and discharge patients who are anaesthetised in hospitals and allowed to proceed home, sometimes under the influence of potent analgesic drugs.*

Hutchinson & McNeill (1963) noted that nearly half their patients went back to sleep for up to seven hours following an average total dose of 113.2mg methohexitone. However, premedication of various types was used. They thought it dangerous to send these patients home in under half an hour.

Mann et al (1971) received 357 reports following their study with incremental methohexitone. 17.6% of patients said they felt drowsy or sleepy that day and the next.

Foreman (1974a) noted that 19 patients (total 30) felt tired all day following diazepam (average 19mg) and methohexitone (average 81mg).

Gale (1976) conducted various recovery tests on 16 patients who received a mean dose of 1.51mg/Kg. Impairment could still be measured up to 75 minutes later.

Korttila et al (1975) gave 10 students 1mg/Kg methohexitone for tests. Two hours later, at least 80% felt tired, and 8 hours later, 50% still felt tired. But at least 80% felt fit enough to drive. Simulated driving tests, after 8 hours, showed significantly more performance errors than the base tests.

However, Elliott et al (1962) and Wilkinson (1965) thought that methohexitone was safer because they found that patients who are not completely recovered, are aware of this and will drive more slowly.

Just because recovery seems to be complete is thus no reason for a patient to be allowed to drive till next day. It may also be illegal (Hudson (1965)).

Doenicke et al (1966) found from E.E.G. Studies that even a small amount of alcohol (0.5 litres of beer) was potentiated by methohexitone still present. Patients should not consume alcohol for 24 hours postoperatively.

Thornton (1975) states: *Research has shown that patients' E.E.G.'s show disturbance for twenty four hours following intravenous use of barbiturates, and out-patients were therefore particularly vulnerable to the problems of interaction, for example with alcohol.*

Howells (1968) suggests that: *Until we have a 'legal limit of blood level of anaesthetic drugs' we must continue to issue our post anaesthetic subjects with instructions of great caution.*

1-12-15: DRUGS TO HASTEN RECOVERY

At one time analeptics were widely used in the treatment of acute barbiturate intoxication, but deaths were found to be higher with

their use than without (Harvey 1975).

Bemegride was once thought to be a specific barbiturate antagonist, but it is now seldom used (Blatchley & Drummond-Jackson 1971d).

Elliott et al (1974) used methylphenidate hydrochloride to decrease C.N.S. depression from the combination of *Innovar* and methohexitone.

Kurland (1968) also recommends this drug to hasten recovery time from a combination of methohexitone and pentazocine.

It is structurally related to amphetamine, but its effectiveness, as a mild C.N.S. stimulant in this context, has been questioned by Franz (1975c).

For patients who are just mentally lethargic rather than exhausted, Blatchley & Drummond-Jackson (1971d) give dexamphetamine, but they say that this drug is rarely needed after methohexitone.

1-12-16: CONCLUSIONS

1. Special recovery tests are unnecessary.
2. There is a danger of overdosage and increased recovery time with the M.I.T. Normally patients should be able to walk within five minutes after waking (see Section 1-12-4c).
3. Nitrous oxide, local analgesia and pentazocine help reduce dosage of methohexitone and thereby reduce recovery time.
4. In general, premedication increases recovery time (see Section 1-12-6c).
5. Long treatment sessions need not increase recovery times if dosage of methohexitone is controlled (see 3 above).

6. Surgical stimulation tends to reduce apparent recovery time - probably by increasing the redistribution of methohexitone due to increased cardiac output (see Section 1-7-6b(iv)).
7. Delayed recovery may be due to hypoxia or subclinical epilepsy.
8. Patients must not drive a car or undertake important work for the rest of the day following the administration of methohexitone.
9. Patients should be escorted home by a responsible adult.
10. Despite an apparent early recovery from methohexitone, full recovery may take up to twelve hours.
11. Patients must not consume alcohol on the same day as receiving methohexitone.
12. Analeptics should not be used in an attempt to hasten recovery.

1-13

DEATHS

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1-13-1: LACK OF DETAILED REPORTS

The Sydney anaesthetist, Sara (1974), complains that despite verbal reports of complications on the local scene, few are reported in the scientific press. *The intent, presumably, is not to detract from a technique which is still in its infancy in this country. This is quite wrong.*

Because of the difficulties experienced in the past with establishing cause of death in dental fatalities, it has been difficult to formulate guidelines which may help to avoid the main dangers. The British Medical Journal suggests setting up a confidential system of enquiry, separate from the Coroner's court (Editorial 1975a).

The Australian Society for the Advancement of Anaesthesia and Sedation in Dentistry has recently set up a Complications Committee to investigate every complication and death that occurs with dental anaesthetics and sedation in Australia (Sheridan 1977a).

1-13-2: REPORTS OF DEATHS

Seldin & Recant (1955) examined all dental deaths between 1943 and 1952 in New York. There were no deaths attributable to barbiturates. Admittedly this is before methohexitone was introduced, but at that time thiopentone was being used in a similar way.

Goldman (1964) studied the dental anaesthetic deaths that occurred between 1952 and 1961. There were a total of 134 deaths. He reported that the incidence was increasing (see also Bourne et al 1964).

The report of the Joint Subcommittee of the British Department of Health (Swiss 1967) tabulates all the reported deaths that mention general anaesthesia in dentistry in England and Wales between 1959 and

1965. Of the 51 deaths, three involved methohexitone in combination with other drugs. No death was associated with the administration of methohexitone as sole agent (see also S.A.A.D. Report 1971).

Bourne (1966) analysed 37 dental deaths. In only three did methohexitone feature. I presume that these are the same three cases as reported by Swiss (1967).

Drummond-Jackson (1969b) says that there were no deaths in 1966 and 1967. However, in 1968 three deaths associated with methohexitone were reported. In one of these the intermittent technique was used.

Bourne (1970b, 1970c) reports on a further sixteen deaths, and Bourne (1973a) discusses fourteen more between 1970-73. Not all these deaths involved methohexitone.

Tomlin (1974a) analyses 46 deaths occurring in England between 1963 and 1968. Not all of these involved methohexitone, and some were with local analgesia only.

The American Society of Oral Surgeons reports on anaesthetic deaths from its members in 1972. In all eleven cases were reported (Driscoll 1974).

In N.S.W., there were no deaths from general anaesthetics administered by dentists between 1960 and 1970 (Woods 1971). In 1976 in N.S.W., two deaths were associated with methohexitone (Sheridan 1977b).

1-13-3: POSSIBLE CAUSES OF REPORTED DEATHS

1-13-3a: Discussion

Anaesthesia-related mortality can arise from misadventures in

technique, or mistakes in drug administration, or adverse effects of agents used (Office of Health Economics 1976).

Possible causes of death are listed:

- Respiratory failure
- Cerebral anoxia
- Cardiac arrest
- Pulmonary oedema
- Hepatic necrosis

Constable (1964), speaking on behalf of the medical protection societies, said that the most common cause of fatality associated with dental anaesthesia is obstruction of the airway.

Rollaston (1967) reports arrhythmias during extractions in a 17 year old fit male. He postulates that such arrhythmias may explain occasional deaths. However, Tollas et al (1967) do not think arrhythmias are significant.

From the results of their study, Wise et al (1969) note, . . . *the technique of intermittent methohexitone must be regarded as having serious detrimental physiological effects, which may well have been the cause of reported deaths.*

Bourne (1969b) takes this statement to task and discusses his earlier reports. In those cases where the patient was sitting upright during treatment he comments: *In most, perhaps all, these cases the collapse was probably due to an ordinary fainting attack, and we should blame not the anaesthetic but the upright or semi-upright position of the patient.*

Danziger (1969) says that in most of the cases cited by Bourne, hypoxia is an obvious factor and cannot be excluded from any. He feels that dental anaesthesia without intubation cannot be free of hypoxia.

Tomlin (1974a) concluded that hypoxia rather than fainting, was the main cause of the deaths he investigated.

1-13-3b: Drummond-Jackson sues Wise et al

Drummond-Jackson (1969b) decided to issue a writ against Wise et al because of interviews they had with the press concerning deaths under incremental methohexitone.

Drummond-Jackson (1969a) asked Wise et al to substantiate their claim that several deaths had occurred with the minimal incremental technique. (See also S.A.A.D. Report 1972d.)

However, Drummond-Jackson (1974) reported the death of one of his own patients under the incremental technique. He said: *I do not think this was an anaesthetic death but an exceedingly serious form of faint.*

1-13-3c: Position of the patient

Robinson (1966) stated that: *It is basically wrong to keep a patient in an upright position and then do anything which may cause a fall in blood pressure or partial anoxia.*

Coplans (1967a) says that the supine position does not necessarily protect patients against cerebral circulatory failure because it may

allow pooling of venous return. That the supine position is safer *are both unjustified and misleading to the dental practitioner.*

Coplans & Curson (1976) compare the dental ambulant anaesthetic deaths in England for 1971 and 1974:

1971:	8 deaths	-	1 supine
		-	5 sitting
		-	2 unstated
1974:	9 deaths	-	6 supine
		-	1 sitting
		-	2 unstated

They argue that because of prior publicity more people are now being anaesthetised in the supine position, and the figures show that more deaths are now occurring in that position. The supine position has not protected these patients.

Bourne (1976b) discussed these 1974 figures which he says were 10, not 9 deaths. He obtained information on 5 of the *supine* deaths directly and found that:

- 2 cases were not horizontal during treatment.
- 2 cases were horizontal for only part of treatment.
- 2 cases were bizarre and position could have no effect.

He concludes: *It would be unsound on the basis of the above 6 cases to decry the horizontal posture.*

1-13-4: REPORTED DEATHS

In Table 13-1 below, I have attempted to summarise the reports of deaths associated with methohexitone alone or in combination with other drugs, given for dental treatment usually on outpatients in dental surgeries.

The following abbreviations have been used in Table 13-1:

Anaes	-	Specialist anaesthetist
Dent	-	Dentist
Gas	-	Nitrous oxide and oxygen
G.P.	-	General medical practitioner
Hal	-	Halothane
Operat	-	Operator
P.M.	-	Post mortem results
Succinyl	-	Succinylcholine
Trichloreth	-	trichlorethylene

TABLE 13-1: REPORTED DEATHS INVOLVING METHOHEXITONE							
REFERENCE	AGE	SEX	HEALTH	DRUGS	WHO GAVE	POSN PATIENT	NOTES
Goldman (1964)	43	M	Aortitis	M, Gallamine, Succinyl, Gas, ?	Anaes	Supine	Hospital anaesthetic
Bourne (1966) case 2 Brierley & Miller (1966) Tomlin (1974a) Case S19	40	M	Good	M = 60mg, gas, hal	?	Upright	Did not recover consciousness. Died 28 days later. Cerebral ischaemia
Bourne (1966) Case 7	72	M	Good (?)	Methohex only	G.P.	Upright	Died immediately. Evidence of cardiovascular generation at post mort.
Bourne (1966) Case 18 Tomlin (1974a) Case S18	55	F	Good	Methohex=100mg Gas, trichloreth	2nd Dent	Upright	Died immediately. Tomlin thinks of cerebral ischaemia, present for some time before death
Bourne (1970c) Case 1 Tomlin (1974a) Case S20	14	F	Good (nervous)	Methohex=50mg	Anaes	Upright	Died immediately. Bourne = from fainting. Tomlin = no, rather from apprehension leading to arrhythmia pulmon. oedema
Bourne (1970c) Case 2 Tomlin (1974a) Case S29	42	F	Good (nervous)	Methohex=70mg Succinyl=100mg Intubated, gas	Anaes	45°	Did not recover. Died 4-5 months later. Hypoxia ?

TABLE 13-1 (continued)

REFERENCE	AGE	SEX	HEALTH	DRUGS	WHO GAVE	POSN PATIENT	NOTES
Bourne (1970c) Case 8 Tomlin (1974a) Case S16	30	M	Good (nervous)	Induced with Methohex=100mg + increments	Operat	45°	Did not recover. Died 4½ days later. Cerebral hy- poxia. Tomlin thinks stag- nant anoxia, not faint
Bourne (1970c) Case 9 Cameron et al (1971)	5	F	Good	Methohex=40mg succinyl intubated	Anaes	Upright	Died immediately. P.M. showed pseudocholineste- rase half normal
Bourne (1970c) Case 13	8	M	Good	Methohex=30-40mg gas + hal	Anaes	Upright	P.M.= methohexitone con- taminated with halothane. Oxygen failed
Bourne (1970c) Case 14 Tomlin (1974a) Case S6	7	F	Good	Methohex=40mg + pentobarbitone pethidine, hyoscine, L.A.	Operat	Supine	Apnoea due to drug combin. Dentist ill equipped, no oxygen
Bourne (1970c) Case 15 Death (1973) Tomlin (1974a) Case S4	29	F	Good (nervous)	Pethidine=25mg Hyoscine=0.4mg Methohex=60mg L.A.= 4 amps	Operat	Supine	<i>Lewes case.</i> After L.A. convulsions then death. P.M.= congenital aneurism hypertensive response from L.A. during antianalgesic phase of methohex
Death (1974a)	29	M	Good	Methohex=125mg pure nitroux ox.	Operat	?	Died in hospital. P.M. Primary respiratory arrest. Oxygen ran out

TABLE 13-1 (continued)

REFERENCE	AGE	SEX	HEALTH	DRUGS	WHO GAVE	POSN PATIENT	NOTES
Death (1974b)	17	F	Good (nervous)	Methohex=100mg + increments	Operat	?	Did not recover, died 7 days later. Operator new graduate, little experience
Death (1974d) Tomlin (1974b)	20	F	Good	Methohex=140mg + increments diazepam=10mg	Operat	Supine	Died in hospital. P.M. = undiagnosed anoxia. Operator new graduate
Drummond-Jackson (1974) Blatchley (1974c) Blatchley (1975) Death (1975) Tomlin (1974b)	28	M	Good (altitude sickness)	Methohex=140mg + increments Diazepam=10mg (maybe 6.5mg)	Operat	Supine	D.J.= <i>Serious form of faint</i> . Never recovered, died in hospital. Ambulance men carried him up-right, may have contri-buted
Death (1976)	34	M	Good (slightly fat)	Methohex=100mg 25% nitrous ox.	2nd Dent	45°	Never recovered. P.M. = generalised cerebral ischaemia as a consequence of cardiac arrest
Tomlin (1974a) Case S13	?	F	?	Methohex=50mg succinyl=50mg intubated. Hal + trichloreth + air	Anaes	Supine	Cyanosis. Died 13 hours later
Driscoll (1974)	under 10	?	Good	Methohex + gas	Operat ?	?	Died on recovery. Cardiopulmonary collapse

TABLE 13-1 (continued)

REFERENCE	AGE	SEX	HEALTH	DRUGS	WHO GAVE	POSN PATIENT	NOTES
Driscoll (1974)	under 20	?	Good	Methohexitone	Operat ?	?	Aspiration of vomit. Died 2 months later
Driscoll (1974)	40	?	Good	Methohex + gas	Operat ?	?	Cardiac arrest on recov.
Driscoll (1974)	60	?	Fair	Methohex + gas	Operat ?	?	Died 5 days later. Cardiac arrest on recov.
Driscoll (1974)	70	?	Fair	Methohexitone	Operat ?	?	Myocardial infarct. on recovery
Driscoll (1974)	50	?	Fair B.P. high	Methohex + L.A.	Operat ?		Myocardial infarct. on recovery
Sheridan (1977b) Case 1	32	F	Good ?	Pentobarbitone Atropine Pentazocine Diazepam Methohexitone	Operat	?	Died 12 hours later. P.M. = thyrotoxicosis ? hypoxia
Sheridan (1977b) Case 2	6	M	Good ?	Halothane, gas fentanyl methohexitone	Operat	?	Died 10 days later. P.M. = Astrocytoma
Death (1977)	7	M	Good	Methohex=90mg Atropine=0.6mg + gas	Operat	Supine	Severe cerebral anoxia. N ₂ O connected to O ₂ supply
Death (1977)	30	M	Rheumatic fever as child	Methohex=80mg Gas + Halothane	2nd Dent	45°	Died three weeks later. Severe cerebral anoxia

1-13-5: DISCUSSION

The table above lists the details of 27 patients who died after receiving methohexitone for dental treatment.

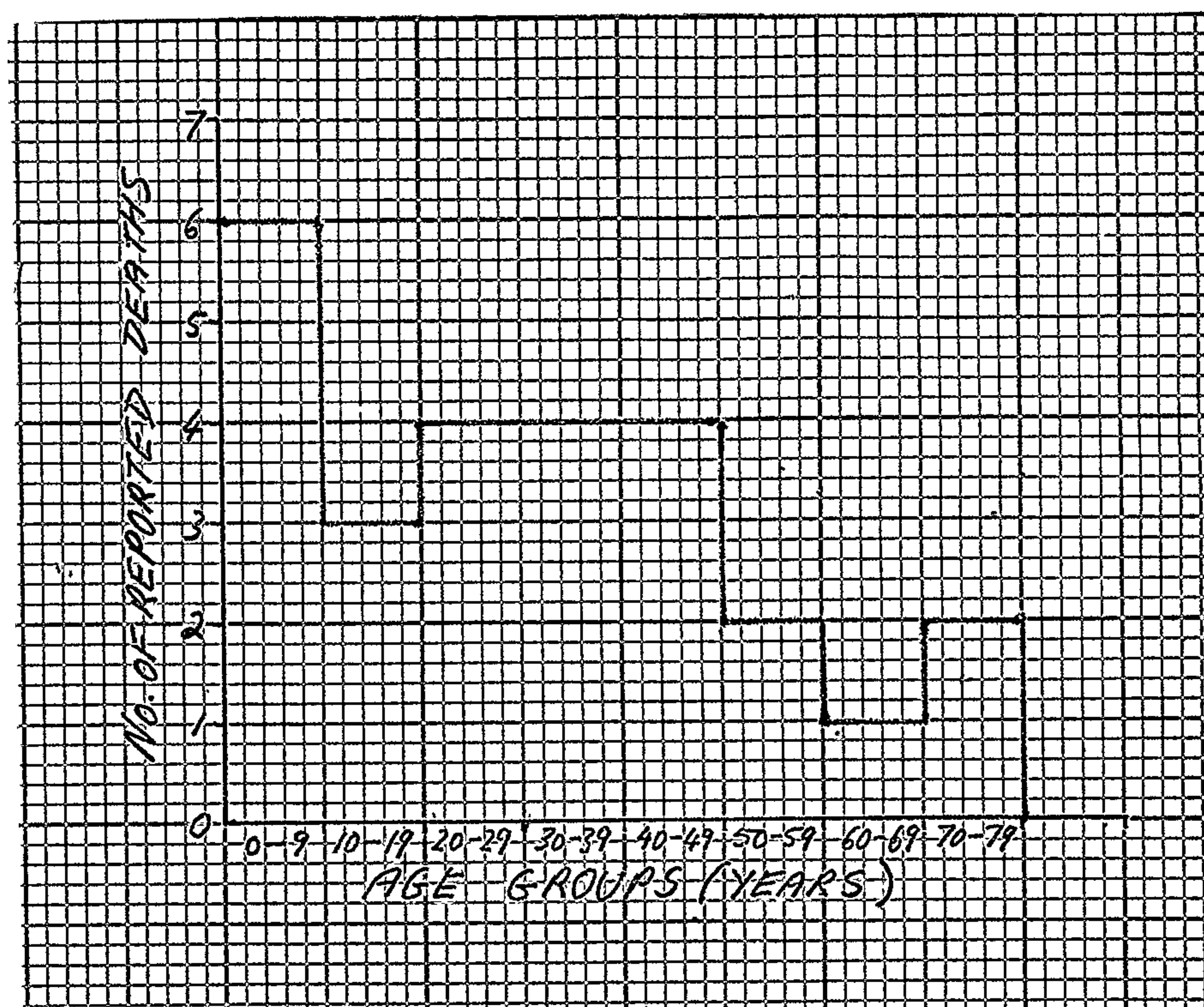
This number is likely to be conservative because of the difficulty in obtaining such information.

However, I feel that several facts emerge. These are discussed below:

1-13-5a: Age of patients who died

The age was reported in 26 deaths only. In the histogram below, the frequency of deaths in each of eight age groups is tabulated.

DIAGRAM 13-1
FREQUENCY OF AGE GROUPS IN 26 DEATHS



If it could be assumed that the ages of all patients who have received methohexitone were uniformly distributed amongst the eight age groups, then the expected number of deaths in each group would be 3.25 deaths for the total number of 26 deaths.

The 0-9 year old age group has the highest frequency of deaths; more than twice that expected.

Furthermore, it is most unlikely that the ages are uniformly distributed. Table 13-2 below lists four studies in which the percentage of patients in similar age groups is given:

TABLE 13-2 FOUR STUDIES OF METHOHEXITONE FOR DENTISTRY WHERE NO ADMINISTRATIONS >1000		
AUTHOR	AGE GROUP	% OF TOTAL
Myers & Coltman (1961)	6-10	0.9
Young & Whitwam (1964a)	-10	0.0
Litchfield & Gerard (1971)	1-11	18.93
This study	0-10	0.6

The mean percentage is 5.1%

If it could be assumed that the group 0-9 years represents only 5% of all administrations of methohexitone for dental treatment, then of 26 deaths we could expect 1.3 deaths in this group.

To test the significance of this difference with the six deaths reported for the group, I conducted a χ^2 test:

AGE GROUP (Years)	EXPECTED NO. OF DEATHS	ACTUAL NO. OF DEATHS	χ^2
0-9	1.3	6.0	17.884
Others	24.7	20.0	
TOTAL	26.0	26.0	

This is a highly significant difference ($0.001 > p$) and it is most unlikely that the large number of deaths in the 0-9 year group occurred by chance alone.

Whilst certain assumptions have been made in arriving at the significance of these figures, one must nevertheless question the use of methohexitone in this age group.

The high death rate may be related to more difficult airway maintenance in children and anoxia was a feature in every case.

1-13-5b: Position of patient during surgery

TABLE 13-3 POSITION OF PATIENT		
POSITION	NO.	%
Upright	10	37
Supine	7	26
Unknown	10	37
TOTAL	27	100

Because of the large number of patients whose position was not reported, it is impossible to draw any conclusions.

1-13-5c: Health Status

TABLE 13-4 HEALTH STATUS		
HEALTH	NO.	%
Good	18	66
Poor	8	30
Unknown	1	4
TOTAL	27	100

In many cases, the poor health status was diagnosed at post mortem only.

1-13-5d: Hypoxia

In 18 of the deaths, hypoxia was stated as a possible cause of death, that is 66.7%.

1-13-6: SUMMARY OF CONCLUSIONS FROM STUDYING 27 DEATHS

1. Information is often incomplete.
2. The dangers of hypoxia are very real: particularly at risk are children, patients in poor health, patients who are kept upright, and patients on whom drug combinations are used.
3. Inexperienced operators should definitely not administer methohexitone and carry out the work at the same time.

1-14

COMPARISON OF METHOHEXITONE WITH
OTHER INTRAVENOUS ANAESTHETICS

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1-14-1: INTRODUCTION

In this section I review the literature that has compared methohexitone with similarly acting drugs that could have or might replace its use in dentistry.

1-14-2: COMPARING METHOHEXITONE WITH THIOPENTONE AND OTHER BARBITURATES1-14-2a: Less smooth maintenance and induction

When methohexitone was first used in clinical trials, many workers would not recommend it because of the high incidence of excitatory phenomena, and cough and hiccough it produced.

Heaton (1956) compared methohexitone and thiopentone and recommended thiopentone because three patients who received methohexitone had near convulsions (see also Sections 1-9-4c and 1-7-1j).

Egbert et al (1959) were interested in finding out if methohexitone would be more suitable for outpatient surgery than thiopentone. However they recorded a higher incidence of motor disturbances with methohexitone which they stated, . . . *will probably preclude the widespread acceptance of . . . methohexitone.*

When used for minor gynaecological surgery, methohexitone was found to produce a less smooth anaesthetic than thiopentone (Jolly 1960; Dundee & Moore 1961a; Ogilvie 1962).

Barron & Dundee (1961) reviewed the then recently introduced barbiturates and stated that: *Methohexital alone appears to offer the only advance in the field of intravenous barbiturate anaesthesia.* But the incidence of excitatory phenomena was a disadvantage.

1-14-2b: Methohexitone use - widespread

Despite these early adverse reports, methohexitone continued to be used, especially for dental treatment. Garber (1976) said that, *currently the use of methohexitone . . . by dentists in the United States is widespread.*

A survey of anaesthetic techniques used by oral surgeons in Pennsylvania showed that 69% preferred to use methohexitone to other barbiturates (S.A.A.D. Report 1975b).

1-14-2c: Economy of methohexitone use

Unlike thiopentone, a solution of methohexitone is stable and will last many weeks. This is an economical advantage which may have been attractive (Blatchley 1961; Dundee 1965a). However, it may be unwise to store methohexitone in this way (see Section 1-2-1).

1-14-2d: Preference of patients

Recant (1960) asked 100 patients, who previously had received thiopentone (for oral surgery as outpatients) and who now received methohexitone, which they preferred. 99 preferred methohexitone because they felt less depressed and more alert afterwards.

Korttila et al (1975) gave 50 students either methohexitone, thiopentone, propanidid or althesin in equipotent doses. Methohexitone provided the most pleasant anaesthetic and 90% of those who received methohexitone thought it was pleasant compared with 60% who received thiopentone.

Apparently the loss of consciousness is more unpleasant with sulphur containing barbiturates. With methohexitone, patients are

usually unaware that they have been asleep (Hudson 1965).

Induction with thiopentone gives patients a characteristic garlic taste due to the sulphur radical. This taste is absent with methohexitone (Drummond-Jackson 1975c).

1-14-2e: Potency of methohexitone.

Wyant et al (1957) compared seven intravenous barbiturates and found that methohexitone was the most potent. *The other agents in line of increasing potency would appear to be methitural, dolitrone & hexobarbitone, with methitural closest to thiopentone and thiamylal.*

Egbert et al (1959) found that methohexitone was two and one half times as potent as thiopentone, and its effect lasted two-thirds as long, yet recovery was twice as fast.

Green & Jolly (1960) found that methohexitone was three times as potent as thiopentone.

Thomas (1967) claimed a more accurate method for determining potency and put methohexitone at 2.75 times as potent as thiopentone.

Clarke et al (1968) found that methohexitone is slightly more powerful than had previously been supposed. They describe a method for estimating relative potencies of intravenous anaesthetics, and derive a potency ratio for methohexitone/thiopentone of 3.3/1.

Because it is more potent, methohexitone can be given in weaker solution, and thus less tissue irritation is produced compared with thiopentone (Dundee 1965a).

1-14-2f: Recovery

Redish et al (1958) compared thiopentone, methitural and methohexitone for simple oral surgery on outpatients. They found that the rate of recovery from methohexitone was significantly more rapid than from comparable doses of the others.

Of hundreds of barbiturates tested for a significant reduction in recovery time, methohexitone was the only drug that did so (Recant 1960).

Wyant & Barr (1960) found a highly significant difference between thiopentone and methohexitone when used on women for D. & C. The mean waking time was much shorter after methohexitone.

Drummond-Jackson (1960) gave an equipotent dose of methohexitone to 200 patients who previously had received thiopentone, for short dental treatment. He noted that: *Five patients whose records had been marked to show unusually delayed recovery after thiopentone gave no sign of delayed recovery, nor did they have any after-feeling of tiredness.*

Douglas (1960) found that the main drawback of the use of thiopentone to produce prolonged anaesthesia for one appointment dental treatment in children, was delayed recovery.

Although this may not be a serious problem in hospital, he says it . . . *is quite a serious disadvantage* with ambulatory patients. He tried other barbiturates to overcome this problem, without success, until methohexitone became available.

Compared with thiopentone, methohexitone offers a more rapid

recovery of consciousness with an absence of hangover (Dundee & Moore 1961a; Christenson et al 1961; Barlow & Gottlich 1962; Ogilvie 1962; Danziger 1962; Goldman & Harris 1963; Dundee 1963).

Compared with thiopentone, recovery from methohexitone seems less related to dosage (Coleman & Green 1960); and Redish et al (1958) did not observe any evidence of accumulation with larger doses.

1-14-2g: Barbiturate of choice for ambulatory patients

Because methohexitone offers a quicker recovery, it became the barbiturate of choice for ambulatory anaesthesia. Because it is less cumulative than thiopentone it became the barbiturate of choice for the minimal incremental technique for dental treatment (Polyblank 1974).

Despite the advantage of rapid recovery, methohexitone has not taken the place of thiopentone in hospital anaesthetics. Probably because there, the use of pre and postoperative medication for analgesia masks the quick recovery (Hudson 1965).

Recant (1960) and Weinstock (1960) observed that because there is less postanesthetic euphoria associated with methohexitone, more patients wept on recovery than did with thiopentone.

1-14-2h: Methohexitone has least cardiac effect

Allen et al (1968) recorded prolonged cardiovascular and respiratory depression, extending into the postoperative period, from thiopentone. They could not recommend its use for oral surgery on an outpatient basis.

Methohexitone has less of a tendency to depress blood pressure than other barbiturates (Dundee & Moore 1961a; Dundee 1963; Dundee 1965b). The periods of hypotension produced by methohexitone are

shorter than those produced by thiopentone, making methohexitone more suited to outpatient use (Dundee 1965a).

1-14-2i: Discussion

Bourne (1975c) says that there is little to choose between thiopentone, hexobarbitone and methohexitone.

But because of the marginal advantages offered by methohexitone, Young & Whitwam (1964a) were able to state: *It is probably true to say that this drug has become the intravenous agent of choice for dental anaesthesia.*

Barron & Dundee (1961) predicted that the future may rest with the non-barbiturate groups of drugs.

The barbiturates possess some undesirable properties which, although able to be modified by changing the side chains, probably never will be completely eliminated (Dundee 1961).

1-14-2j: Conclusion

Methohexitone compares favourably with thiopentone and the other barbiturates.

It is unlikely that another barbiturate will replace methohexitone for outpatient dental anaesthesia.

1-14-3: STUDIES COMPARING METHOHEXITONE AND PROPANIDID

1-14-3a: Introduction

Propanidid is a phenyloxyacetic acid derivative of eugenol. It was first introduced into the U.K. in 1962 (Howells 1968).

1-14-3b: Quick recovery with propanidid

Howells et al (1967) compared equipotent doses of propanidid and methohexitone. They found that the duration of anaesthesia does not differ significantly with either.

However with propanidid, recovery is much quicker and from E.E.G. studies, Doenicke et al (1966) showed that complete recovery from propanidid occurred in two hours, compared with twelve with methohexitone.

Korttila et al (1975) compared methohexitone, thiopentone, propanidid and althesin. Recovery was quickest with propanidid and subjects demonstrated no impaired driving skills in a special test.

Propanidid is not stored in the body and is available for more rapid biotransformation than is methohexitone. Hence the faster recovery (Clarke & Dundee 1966).

1-14-3c: Other pharmacological advantages

An additional advantage of propanidid over methohexitone is that propanidid produces a lower incidence of muscle movements, cough and respiratory depression (Sanakawa 1965).

In women undergoing D. & C., Lind & Roland (1969) recorded the incidence of cough and hiccough with methohexitone and with propanidid:

TABLE 14-1: COUGH & HICCOUGH		
DRUG	INCIDENCE	%
Methohexitone	60 out of 98	(61%)
Propanidid	7 out of 88	(8%)

Propanidid has less effect on blood pressure than methohexitone: Dundee (1965b) found that even after prolonged operations necessitating the administration of 3-5 grams, little troublesome hypotension was observed.

Although hypotensive episodes have been reported with propanidid (Chambiras 1972a; S.A.A.D. Report 1976b).

1-14-3d: Disadvantages of propanidid with the M.I.T.

Propanidid is one fifth as potent as methohexitone (Howells et al 1967) and, because it is quickly destroyed once injected, there is lack of cumulative effect. Thus, large volumes of propanidid must be injected if an incremental technique is used, which makes for difficult working conditions (Clarke & Dundee 1966).

Cadle et al (1968) used propanidid as sole agent, with an incremental technique, as an outpatient dental anaesthetic. They found that in some cases it produced muscular rigidity and a tightening of the jaw muscles. They recommend that for conservative dentistry, methohexitone is more suitable.

Where large volumes of propanidid have to be used for the incremental technique, it is more expensive than methohexitone (Kay 1970).

1-14-3e: Disadvantages of propanidid - vomiting

Dundee (1965c) found a higher incidence of vomiting and nausea with propanidid than with methohexitone after a standard gynaecological operation. I have tabulated his results:

TABLE 14-2: VOMITING		
INCIDENCE IN 1ST POSTOP. HOUR	300 PATIENTS METHOHEXITONE	200 PATIENTS PROPANIDID
Nausea	9	17
Vomit	9	22
TOTAL	18	39
%	6%	19.5%

Lind & Roland (1969) conducted a similar study and found the incidence of vomiting with propanidid to be 28%.

Dundee (1965c) was unsure as to the cause. It could be a property of eugenol derivatives or a result of the more rapid recovery from propanidid.

1-14-3f: Disadvantages of propanidid - venous complications

The incidence of venous complications with propanidid is higher than with methohexitone (Hewitt et al 1966).

Propanidid causes extensive thrombophlebitis in about 1% of cases which Kay (1970) found to be unacceptable. Because of similar complications, Lind & Roland (1960) never use veins on the back of the hand for propanidid.

These complications are probably due to the fact that propanidid is presented as a 5% solution in oxyphenylated castor oil. This is a rather viscous solution, but it can be diluted with distilled water (Lee & Atkinson 1973b). This could possibly reduce the incidence of thrombophlebitis.

1-14-3g: Disadvantages of propanidid - allergic reactions

Chambiras (1972a) said that there had been several cases of allergic reaction with propanidid, including one anaesthetist who developed a rash on his fingers from touching the solution.

Young (1974) experienced a case of anaphylactoid reaction to propanidid, or its vehicle, and has abandoned the use of the drug for dental outpatients.

Dundee (1976) compared the number of authentic sensitivity reactions reported with propanidid, with those reported with thiopentone. During the ten previous years there were at least 30 cases with propanidid, compared with 30 for thiopentone over 40 previous years. (Unfortunately no figures for methohexitone were given, but see Section 1-8-2e).

The most common reports of allergic response to propanidid are flushing of the skin and urticaria (S.A.A.D. Report 1976b).

1-14-3h: A mixture of propanidid and methohexitone

Because propanidid and methohexitone exhibit different side effects, a mixture of both should have less side effects than either separately (Dundee & Lyons 1967).

A dentist-anaesthetist group practice in Dublin had used a mixture of both successfully in 8,000 cases (Dundee et al 1967).

Kurland (1967) suggested a mixture containing 300mg propanidid and 30mg methohexitone for induction.

Dundee & Lyons (1967) prepared a mixture containing 10mg/ml metho-

hexitone and 25mg/ml propanidid. This formula was used by Lyons et al (1967) in 400 cases, including 29 adults who were to have extractions. Dosage was calculated on the methohexitone content as 0.7mg/Kg.

The course of anaesthesia was uneventful in 86%; minor muscle movements occurred in the remainder. Recovery was quicker than if methohexitone alone had been used. They thought it could be useful for dental outpatient procedures, but they did not think it would replace methohexitone.

The manufacturers of methohexitone have warned against using such mixtures because of a rapid breakdown of the eugenol content which could be toxic (Addendum 1967).

Dundee & Lyons (1967) noted that after about one week, the mixture becomes increasingly acidic, cloudy and less potent. But they found that the mixture was clinically acceptable and they suggested that only fresh solutions be used.

1-14-3i: Conclusion

1. Propanidid is not suited to the M.I.T. because large volumes must be used.
2. Propanidid has a high incidence of thrombophlebitis.
3. Propanidid has not replaced methohexitone for outpatient dentistry.

1-14-4: STUDIES COMPARING METHOHEXITONE & ALTHESIN (ALFATHESIN)

1-14-4a: Introduction

Feiglin & Reade (1973) discuss the development and use of steroids for anaesthesia, including the mixture of two steroids, alphaxalone and

alphadolone, known as althesin (CT 1341, Glaxo.- In Australia marketed as Alfathesin).

The use of althesin is summarised by Litchfield & Lambert (1975).

1-14-4b: Side effects of althesin

Muscle movements are reported to be similar to those produced by methohexitone (Andrew et al 1973).

Althesin is more potent than methohexitone, but less cumulative (Sutton 1972). Hannington-Kiff (1972a) found that recovery from a single dose of althesin was more rapid than from an equipotent dose of methohexitone.

However, Carson (1975) and Carson et al (1975) found that recovery from methohexitone is quickest.

Althesin produces less vomiting and nausea on recovery than does methohexitone (Sutton 1972), but produces a higher incidence of post-operative crying (Andrew et al 1973).

Althesin shows a preponderance of reactions affecting the respiratory and cardiovascular systems, such as severe bronchospasm and profound hypotension (S.A.A.D. Report 1976b).

1-14-4c: Low volume of althesin

Andrew et al (1973) found the main advantage of althesin to be the small volumes used. But Sutton (1972) says that because of the low volume used, one must give althesin with caution otherwise an increase in muscle twitching and hypotension will result because of the danger of overdosage. The small volumes used result in less local venous com-

plications with althesin (Andrew et al 1973).

1-14-4d: Allergic reactions with althesin

Litchfield & Lambert (1975) reported two allergic reactions out of 135 administrations and they stated, . . . *whilst the allergic reactions were not severe, it was certainly much more frequent than that which occurs when using methohexitone.*

In the five years that althesin had been available, Dundee (1976) notes that there are more than 100 authentic reports of sensitivity. The Australian Prescriber (1976) reviewed reports of its implication in allergic reactions.

1-14-4e: Cost of althesin

It is six times as expensive as methohexitone and its marginal advantages do not warrant changing to it, particularly when it is packaged in small dose ampoules only, which makes its use in an intermittent technique difficult (Litchfield & Lambert 1975).

1-14-4f: Conclusion

The high incidence of allergic reactions is a disadvantage and will preclude the replacement of methohexitone by althesin.

1-14-5: DISCUSSION

Thornton (1971) said: *Methohexitone, an otherwise valuable intravenous agent, lacks the pharmacological properties which would make it a suitable agent for the purpose of sedation for conservative dentistry.*

Grainger (1972) commented: *At the present time methohexital is the most suitable agent . . . offering pain and anxiety control over short duration appointments.*

Intravenously, the barbiturates have held their supremacy as induction agents with negligible side-effects, for over 40 years (S.A.A.D. Report 1975a).

1-14-6: CONCLUSION

Methohexitone is the intravenous anaesthetic of choice and at present there seems no other similarly acting drug that has enough advantages to replace it for dental treatment.

1-15

GENERAL CONCLUSIONS

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1-15-1: INTRODUCTION

Detailed conclusions appear at the end of each section and sometimes, when appropriate, within each section.

In this section, I have presented specific conclusions which I feel have clinical significance. These conclusions, compounded from several previous sections, may help to highlight the areas of greatest concern.

1-15-2: POPULARITY OF METHOHEXITONE

Methohexitone is the most popular intravenous anaesthetic for dental outpatient use. Patient acceptance is high and the incidence of obvious complications is low.

Obvious complications are those which will disrupt the efficient running of a busy practice and those which will upset the normal routine of patients.

Recovery is apparently rapid and patients are usually able to leave the surgery within thirty minutes of completion of treatment. This may be seen as an economic advantage to a dentist not prepared to equip his surgery with adequate recovery facilities.

Patients will take advantage of the apparent rapid recovery by returning to work, or driving afterwards.

Patients may also be grateful for the low incidence of vomiting and nausea, but some dentists have become lax about enforcing the rules of fasting.

Patients seem to be hardly inconvenienced at all!

The apparent simplicity and safety of the M.I.T. is responsible for its indiscriminate use by inadequately trained and poorly equipped dentists.

Dentists who allow such practices have been justly criticised.

However such misuse, which can be corrected by training and experience, should not be allowed to cloud the real issue of whether methohexitone has a continuing place in dental treatment or not.

1-15-3: THE MINIMAL INCREMENTAL TECHNIQUE

An induction dose of 80mg will produce about three minutes working time. These figures will be modified by several factors (e.g. presence of pain, patient weight, age, sex, health and degree of apprehension).

The technique is usually unsupplemented and anaesthesia is maintained by small increments of the drug titrated to the patient's requirements.

The aim is to rely on the amnesic properties of the drug and thus keep patients very light with reflexes present. The presence of the eyelash reflex is seen as evidence of light anaesthesia.

However, opponents argue it is very difficult to maintain an even level of anaesthesia throughout any procedure and there will be times when anaesthesia deepens.

There is evidence that the return of the eyelash reflex cannot guarantee a light level of anaesthesia and there is evidence of aspiration, indicating loss of protective reflexes during the M.I.T.

Some patients become restless under the M.I.T., due to their resistance or the presence of pain, and hurried or incomplete work may result.

1-15-4: RESPIRATORY OBSTRUCTION

Falls in arterial oxygen levels, measured during the M.I.T., have been blamed on respiratory obstruction more than any other cause.

This is a serious complication because it has often been undetected clinically. Cyanosis, a sign of reduced oxygen tension, may also be absent.

It is this one complication more than any other that the administrator must continually guard against.

1-15-5: TACHYCARDIA

Tachycardia, to maintain cardiac output in response to a reduced stroke volume and decreased peripheral resistance, is due mainly to high doses of methohexitone.

1-15-6: OXYGEN SUPPLEMENTATION

A very powerful case has been made for the routine use of high concentrations of oxygen to supplement methohexitone.

Increased concentrations of oxygen have been shown to greatly reduce the danger of hypoxia due to respiratory obstruction.

Sufficiently high concentrations can be delivered through the use of a nosepiece designed for relative analgesia.

1-15-7: LOCAL ANALGESIA SUPPLEMENTATION

It is the very lightness of the M.I.T. which may result in several complications: arrhythmias, elevations of blood pressure, restlessness and jactitations.

The use of local analgesia as a supplement to the M.I.T. has been shown to positively reduce these and other complications.

The elimination of surgical pain will reduce the incidence of arrhythmias and increases in blood pressure.

In the absence of pain, patients may be less restless and total dosage of methohexitone can be reduced.

The technique should not be abused and toxic doses of local analgesics must be avoided.

1-15-8: DIAZEPAM SUPPLEMENTATION

Following the death of Drummond-Jackson's patient, there has been a general recommendation not to give diazepam after methohexitone.

Diazepam potentiates methohexitone and is a longer acting drug, and in this situation an unpredictable degree of respiratory depression will result.

Used to create a baseline of sedation prior to methohexitone, diazepam has been shown to reduce dosage of methohexitone for long treatments. It helps to reduce the incidence of restlessness.

Probably no more than 10mg need be given and patients should not be taken to the level of ptosis (Verrill sign).

1-15-9: DOSAGE

To avoid the cumulative effects of methohexitone, it has been recommended that total dosage should not exceed 200mg and total working time be limited to ten minutes for surgery and 20 minutes for conservation.

In practice, these limits should be easy to maintain if the technique is not overextended.

Dosage is also a function of solution strength and injection speed. Fast injection rates have been correlated with the complications of cough and hiccough.

Concentrations of 1% and 2% are most commonly used.

1-15-10: DEATHS

From deaths, we must learn how to avoid similar errors in the future. Unfortunately, information is often lacking, but several points arise:

1. The upright position has no place in methohexitone treatment.
2. Children are unsuitable for treatment, probably because their airways are more difficult to maintain.
3. Inexperienced operators should avoid the M.I.T.
4. Frequent lack of adequate emergency equipment.

1-15-11: THE EXPERIENCE OF THE DENTIST

The use of methohexitone demands new skills of patient evaluation which many dentists may not possess, especially if they are new

graduates.

Methohexitone reduces laryngeal competence and the danger of aspiration of debris is ever present.

Correct mouthpack placement is extremely important, but is often unsatisfactory. Keeping the mouth free of debris and coolant requires constant and intense vigilance.

Airway control is another new skill the dentist must learn thoroughly to avoid respiratory obstruction.

Dentists may find it very difficult to acquire these skills unless they work under the close supervision of recognised experts in the field. It probably takes several years to acquire competence.

It must be remembered that with the M.I.T., it is the operator who is ultimately responsible for the safety of the airway because the administrator cannot monitor the pack.

Both administrator and operator must be equally skilled.

P A R T 2

SCIENTIFIC RESULTS

2-1

AIMS

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2-1-1: TO FULFIL NEEDS FOR MORE CLINICAL RESEARCH

1. Australia has produced very little material on the use of methohexitone.
2. Dentists account for less than 50% of authorship of studies investigating the use of methohexitone in dentistry.
3. Less than half the clinical studies published relate to the use of methohexitone for conservative dentistry.
4. Few studies have been undertaken in private practice.
5. The use of methohexitone has only once before been the subject of a Master's Degree.
6. Most studies are limited in number of administrations. Few have studied more than 1,000 and most less than 100 administrations.

2-1-2: TO COMPILE STATISTICS:

1. On a large number of administrations of methohexitone by the minimal incremental technique as it is used in general dental practice.
2. To assess the practicality of recommended maximum dosage limits.
3. To assess the value of diazepam supplementation.
4. To assess the value of local analgesia supplementation.
5. On the incidence of complications.
6. To assess the value of pre-operative and post-operative instructions.
7. To make recommendations for increasing safety.

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MATERIALS

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2-2-1: DRUGS2-2-1a: Methohexitone

The brand of methohexitone used throughout the study was *Brietal Sodium* (Lilly). I prepared a 2% solution by adding 125ml water for injection to a multidose bottle containing 2.5grams methohexitone powder. The solution, once prepared, lasted for several administrations.

2-2-1b: Diazepam

The brand of diazepam used throughout the study was *Valium Roche* (Roche). This is supplied as a 2ml ampoule containing 10mg diazepam. I further diluted the diazepam with an equal quantity of water for injection. Thus a 5ml syringe contained 4ml of solution representing 10mg diazepam (i.e. 2.5mg/ml).

2-2-1c: Atropine

0.6mg atropine, in 1ml ampoules, was used throughout the series.

2-2-1d: Local analgesia

Either lignocaine hydrochloride 2% with adrenalin (*Nurocain* - Glover) or prilocaine 3% with octapressin (*Citanest* - Astra) were used as required.

2-2-1e: Other drugs

(i) Pentazocine (*Fortral* - Winthrop) was used three times. It is packaged in 1ml ampoules containing 30mg.

(ii) Relative analgesia (nitrous oxide sedation) in concentrations not exceeding 30% nitrous oxide.

- (iii) Emergency drugs were available if required. The range was similar to that suggested by the N.S.W. Health Commission (Newsletter 1976b). See Appendix 3.

2-2-2: EQUIPMENT

2-2-2a: Winged infusion sets

For intravenous injection, a 23 gauge disposable winged infusion set was used. The needle was secured to the patient's arm with clear adhesive tape.

2-2-2b: Syringes

The following disposable plastic syringes were used:

10ml for methohexitone

5ml for diazepam

2ml for atropine

2ml for pentazocine

2-2-2c: Armboard

For part of the series the patient's arm was secured by using a *Chelsea* armboard (A.S.A.A.S.D.). No special armboard was necessary when the patient was placed in a *Den-Tal-Ez* chair (D.H.A.) as the arm rests of the chair are adequate.

2-2-2d: Mouthprops

To keep the patient's mouth open during treatment, *McKesson* mouthprops were used. These are supplied in three sizes.

2-2-2e: Sponge packs

To prevent the inhalation of debris and water during treatment, moistened butterfly sponge packs were used. After use the packs were washed and stored in a dilute sterilizing solution.

2-2-2f: Combine dressing

For extractions and other oral surgery, 20cm strips of cotton combine dressing were used to protect the airway from soiling.

2-2-2g: Suction

(i) High volume

High volume, low vacuum suction was used for conservation. The sucker tip was held by the nursing assistant. Great care was taken to keep the pack free of moisture.

(ii) Low volume

A low volume high vacuum sucker (*Clements*) was available for the treatment of emergencies. It was equipped with a Yankauer tip.

2-2-2h: Monitoring equipment

In the majority of cases, monitoring was confined to simple visual observations of respiration, colour and pulse. Occasionally a finger plethysmograph was used.

Blood pressure was measured only when a patient's health was of concern pre-operatively. (See Sections 1-7-10g and 1-10-9a(iv).)

2-2-2i: Emergency equipment

A standard range of emergency equipment, including E.C.G. and defibrillator, was available (see Newsletter 1976b).

2-2-3: PERSONNEL

In every case, I administered the necessary drugs. In the majority of cases, I carried out the work. In some cases, another dentist carried out the work, viz:

1. For children and the aged.
2. For specialised treatment (e.g. periodontal).
3. Where the patient was known to be restless under methohexitone.

In all cases, I was assisted by a fully qualified nursing sister with previous experience in resuscitation. The sister was responsible for supporting the mandible (to avoid respiratory obstruction) and for suction.

In cases where a patient was known to obstruct easily, or it was thought he may obstruct easily, I would support the mandible whilst another practitioner carried out the necessary treatment.

In this way, complications were readily observed and quickly treated.

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2-3-1: FITNESS OF PATIENTS

Patients were assessed verbally and if any doubt existed as to their fitness for methohexitone, approval was gained from their own physician.

To aid in assessing fitness for treatment, patients were requested to complete a medical history form:

TABLE 23-1: EXAMPLE OF MEDICAL HISTORY FORM

Please answer the following questions carefully:—

Surname Christian names.....

Address.....

Date of Birth.....

Phone Nos. Home.....

Work.....

Recommended by:—

Name.....

Address.....

Have you had (or are suffering from):—

Glaucoma.....

Rheumatic fever.....

Shortness of breath.....

Epilepsy.....

Tuberculosis.....

Diabetes.....

Anaemia.....

Heart complaints.....

Excessive bleeding.....

Allergies.....

Asthma or Bronchitis.....

Deep Ray Therapy.....

Women if pregnant state approximate date of confinement.....

Who is your medical practioner.....

Have you had medical treatment within the last 6 months?.....

Are you at present taking medicines, pills, tablets or drugs of any kind?.....

Have you ever had any serious illness?.....

P.T.O.

2-3-2: CONSENT OF PATIENTS

Patients were requested to sign a consent form:

TABLE 23-2: EXAMPLE OF CONSENT FORM

**Instructions to Patients needing a
General Anaesthetic**

1. No food or drink of any kind to be taken for six hours before an anaesthetic appointment.
2. No anaesthetic will be given to any patient under the age of 18 unless accompanied by a responsible adult.
3. The consent form in the case of a patient under the age of 18 must be signed by a parent or legal guardian.
4. Motor vehicle or machinery must not be operated for 24 hours following appointment.
5. Patients are asked to refrain from smoking 12 hours before appointment.

CONSENT FORM

I consent to a general anaesthetic or intravenous sedative being given for the Dental work previously decided upon, and any other treatment which is found to be necessary during the course of such treatment.

.....
(Please sign name here)
If parent or guardian signs,
please state which.

Date

If food or drink had been taken in the six hours prior to the

appointment, then the urgency of the treatment, the reliability of the patient and the ease of the procedure affected the decision to proceed or delay treatment.

2-3-3: POSITION OF THE PATIENT

All treatment was conducted with the patient in the supine position.

The patient, previously assessed as fit, was placed in the supine position. Venepuncture was performed with a 23 gauge needle winged infusion set which was then taped to the arm.

2-3-4: TEST DOSE OF METHOHEXITONE

A 10ml syringe containing 2% methohexitone solution was connected to the infusion set. A test dose of 20mg methohexitone was injected and its effect noted. (See Section 1-10-5.)

2-3-5: ATROPINE AND DIAZEPAM

Where atropine was to be given, the syringe of methohexitone was disconnected and replaced by a 2ml syringe containing 0.6mg atropine. The atropine was administered.

If diazepam was to be also used, a 5ml syringe of 10mg diazepam was next attached to the winged infusion set. The diazepam was administered slowly at the rate of 2.5mg/minute until the desired dosage was given. (See Section 1-11-6h(ii).)

2-3-6: INDUCTION DOSE OF METHOHEXITONE

The original syringe of methohexitone was re-attached to the infusion set and taped to the patient's arm.

To clear his throat of secretions, the patient was asked to cough and then swallow. Next, he was asked to open his mouth widely to allow placement of the prop. The patient was asked to bite on the prop.

The calculated induction dose was administered at the approximate rate of 20mg every 1.5 seconds (see Section 1-5-13).

2-3-7: INDUCTION COMPLETE

Induction was judged complete when:

1. The patient hyperventilated; usually followed by a brief period of apnoea.
2. The patient did not respond to oral commands.
3. Eyelash reflex was lost.

2-3-8: PLACEMENT OF THE PACK

As soon as induction was complete, the pack was carefully positioned and the patient's airway supported.

2-3-9: ADMINISTRATION OF LOCAL ANALGESIA

If required, local analgesia was not administered. In the case of a mandibular block, administration was given before the placement of the pack. (See Section 1-11-4.)

2-3-10: COMMENCEMENT OF TREATMENT

The high volume, low vacuum sucker was placed and treatment begun immediately.

2-3-11: INCREMENTS OF METHOHEXITONE

Additional doses of methohexitone were given by 20mg increments as required.

2-3-12: REST PERIODS

The recommended rest periods were observed. Additional rest periods were allowed:

1. When treatment was changed from one side to the other.
2. When the pack accidentally became wet or soiled.
3. When the patient attempted to swallow.

In these cases the pack and prop were removed and the patient was allowed to swallow naturally and in response to verbal command.

2-3-13: CONCLUSION OF ADMINISTRATION OF METHOHEXITONE

The administration of methohexitone was stopped as soon as it was thought that all painful procedures were complete and the patient could tolerate further treatment during the recovery phase.

The winged infusion set was not removed until completion of treatment in case further methohexitone was required.

2-3-14: REMOVAL OF NEEDLE AND RECOVERY

On removal of the needle from the vein, a cotton roll was taped over the venepuncture point. At this stage the patient was assessed for recovery. If the patient could talk and respond to commands, and felt well, the chair was slowly raised to the upright position.

If, after sitting up for a few minutes, the patient was capable of walking, he was escorted to a recovery room.

2-3-15: RECOVERY ROOM

If the patient was not sufficiently recovered to walk to the waiting room, he was allowed to lie down in a recovery room under observation.

Patients who were sufficiently recovered enough to sit in the waiting room were given coffee. After thirty minutes they were allowed to leave with an escort.

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2-4-1: TREATMENT RECORDS2-4-1a: Information Recorded

At each administration of methohexitone the following information was recorded:

- (i) Date and Administration Number
- (ii) Name, Age and Sex of Patient
- (iii) Dosage of all Intravenous Drugs used
- (iv) Whether L.A. or R.A. were used
- (v) Health Status of Patients: Either
 - (a) Good, or
 - (b) - 0-3 months pregnant
 - 3-6 months pregnant
 - 6-9 months pregnant
 - heart complaint
 - vascular disease
 - respiratory disease
 - heavy smoker
 - asthmatic
 - drug allergy
 - taking drugs
 - taking cortisone
 - taking methadone
 - hepatitis
 - liver
 - epileptic
 - other

(vi) Type (other factors which could affect dosage and complications): Either

(a) None, or

- (b) - heavy muscular build
- small build
- very nervous
- tired
- aggressive
- other

(vii) Complications: Either

(a) none, or

- (b) - slight pain in vein
- severe pain in vein
- thrombophlebitis
- cough: pack became wet
- cough: due to mucous
- slight respiratory obstruction
- severe respiratory obstruction
- laryngeal spasm
- hiccough
- allergic reaction
- asthma attack
- apnoea
- sneezing
- vomiting
- gagging on pack
- pack rejected
- convulsions
- slightly restless
- very restless

- restless as dose wears off
- requires larger dose
- vocal
- other

(viii) Recovery Complications: Either,

(a) None, or

- (b)
- delayed
 - nausea or vomiting
 - crying
 - disorientated
 - very tired that day
 - other

(ix) Types of Treatment:

- simple extractions
- surgical roots extracted
- surgical: third molars
- other surgery
- simple scaling and polish
- deep scaling
- ordinary fillings
- large or deep fillings
- crown preparations
- other crown and bridge procedures
- removal of vital pulp
- open an acute abscessed tooth
- root dressing
- root filling
- occlusal adjustment
- other

(x) Treatment time - in minutes

(xi) Other relevant information

2-4-1b: Example of original record entry

The information was recorded in a book which was ruled off in such a way that an item of data could not be missed.

At the end of each treatment session, the book was entered up by me and checked by my assistant.

An example of the data recorded for one administration is set out in Table 24-1.

TABLE 24-1: EXAMPLE OF ORIGINAL DATA RECORD ENTRY																	
ADM. NO.	DATE	NAME	SEX	AGE	B	A	V	O	LA	RA	TIME	HEALTH	TYPE	RECO- VERY	COMPLIC	TREAT	COMMENT
4299	16/9/76	Miss K.	F	36	140	0.6	5	-	-	-	50min	OK	-	OK	pain vein	2flg S & P	-

Details of abbreviations: B = dosage of methohexitone used
 A = dosage of atropine used
 V = dosage of diazepam used
 O = dosage and name of other drugs used
 LA = local analgesia
 RA = relative analgesia

2-4-1c: Discussion of information recorded

(i) Dosage

At the commencement of each administration, a freshly loaded 10ml syringe containing 200mg methohexitone was attached to the winged infusion set.

If it was necessary to administer more than 200mg, a new, freshly loaded 10ml syringe was attached. At the end of treatment the syringe was removed. The amount of solution remaining was deducted from the original amount and dosage easily calculated.

The syringes and unused solution were discarded.

In a similar manner, diazepam dosage was recorded.

(ii) Duration

The duration of treatment was recorded as the time from injection of the test dose of methohexitone until completion of treatment with the patient sufficiently recovered to sit upright.

Times were recorded to the nearest of: 5, 10, 15, 20, 25, 30, 40, 50, 60, 90, 120, 180, 240 minutes.

A delayed recovery was recorded if, at this stage, that patient was unable to walk without help to the recovery area.

2-4-2: PREPARATION OF RECORDS FOR COMPUTER ANALYSIS

The treatment records were transferred from the original entry book to cards. A separate card was used for each patient (who was allocated a unique number).

To facilitate punching, each unit of information was entered in code form. An example of the record card is shown in Table 24-2:

TABLE 24-2: RECORD CARD		
NAME OF PATIENT	2065	M.56
16/12/75	160B, 0.6A, LA, TROI	5 min

In the case of the patient's record shown in Table 24-2, the decoded record reads: Mr _____, patient No. 2065, a male of 56 years. On 16/12/75, a total dose of 160mg methohexitone, supplemented by 0.6mg atropine and local analgesia, was given for the removal of one root. Duration of treatment was 5 minutes.

2-4-3: COMPUTER RECORDS

All the information was placed into a data base (for details see acknowledgements No. 3).

Due to the number of variables, it was impractical to produce all of the possible statistics. However, any specific combination of all factors can be produced as required.

2-4-3a: Master File List

Two master files were produced on computer printout paper. One was a record of all administrations in sequence of patient number. The second was a record of all administrations in alphabetical order of patient name.

2-4-3b: Statistics(i) Age groups and sex

All reports are shown as two-dimensional tables with columns showing sex and rows showing age groups.

The age groups chosen were thought to represent distinct treatment and complication situations. However, these groupings can be expanded or contracted as required.

An example of one such report is shown in Table 24-4.

TABLE 24-4: EXAMPLE OF COMPUTER REPORT						
REPORT ON DISTRIBUTION OF AGE GROUPS AND SEX ALL ADMINISTRATIONS FOR ONE SIMPLE EXTRACTION						
AGE	MALES		FEMALES		TOTAL	
	NO.	%	NO.	%	NO.	%
0-10	7	2.7	3	1.0	10	1.8
11-18	10	3.9	9	3.1	19	3.5
19-26	97	38.0	144	48.8	241	43.8
27-35	71	27.8	75	25.4	146	26.5
36-50	54	21.2	30	10.2	84	15.3
OVER 50	16	6.3	34	11.5	50	9.1
TOTAL	255	100.0	295	100.0	550	100.0

(ii) Other Statistics

Reports of mean dosage (or time etc.) with standard deviation and range were also produced.

2-4-4: OTHER STATISTICAL CALCULATIONS

The computer reports provided much information for calculations of statistical significance.

For this purpose, a *Pocket Computer Estimate (PC-1201)* (Sharp) was programmed to compute t -tests, χ^2 -tests and confidence limits. All these tests were carried out by me.

In the presentation of the scientific results, only statistically significant differences are commented upon. Where no comment has been made, there is no significance.

2-5

LIMITS OF STUDY

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2-5-1: DISADVANTAGES

Grainger (1973) summarised the disadvantages of a study of this type when he wrote: *As these patients have been treated in private dental practice, observations are necessarily limited and must principally be made on clinical observations. It was not practicable to be completely free of bias, which should ideally be the case in the clinical application of a drug.*

Wyant et al (1957) said that two important factors cannot be controlled:

1. Degree of pre-anaesthetic apprehension. This exists to a greater or lesser degree.
2. State of wakefulness or tiredness of patients treated.

A note was made of patients who were obviously highly anxious pre-operatively. But there was no way of assessing others who may have been as anxious but managed to mask their feelings.

In compiling the results I have tried to be as objective as possible.

2-5-2: ADVANTAGES

The ideal conditions for a clinical study have been summarised by Dundee et al (1962) and Barron & Dundee (1962).

This study has satisfied many of these conditions, viz:

1. The patient population was fairly uniform and patients required reasonably comparably operative conditions. To minimise variables, it is possible to examine each sex separately, as it is to examine

age groups and types of treatment.

2. Because certain pathological states may influence the response of patients, any patients with severe systematic disease were not included.
3. The same operating position was used throughout - supine.
4. The number of patients was large enough to allow for statistical analysis.
5. All administrations were given by me, and the majority of operative procedures were carried out by me; so that stimuli were constant.

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2-6-1: SELECTION

Every patient who attended my practice between July 1973 and October 1976 was eligible to be included in the study. Patients who did not receive intravenous methohexitone as part of their treatment were excluded.

Patients were excluded for the following reasons:

1. The nature of the dental work did not necessitate the administration of methohexitone (e.g. the fitting of dentures).
2. The patient requested not to have methohexitone. In such cases, the patient was referred to another dentist.
3. The nature of the dental work required a general anaesthetic with intubation (e.g. extensive surgery).
4. The patient's medical history was an absolute contraindication to treatment with methohexitone.

Every patient who received methohexitone during the period was included in the study, irrespective of results.

2-6-2: NUMBER OF PATIENTS

2,722 patients were included in the study. Their age and sex distribution is shown in Table 26-1 and Diagram 26-1, and their statistics in Table 26-2.

TABLE 26-1						
AGE & SEX DISTRIBUTION OF ALL PATIENTS						
AGE GROUP (YEARS)	MALES		FEMALES		TOTAL	
	NO	% (*2)	NO	% (*2)	NO	%
0-10	13	1.2	11	0.7	24	0.9
11-18	48	4.3	73	4.6	121	4.4
19-26	374	33.1	673	42.3	1047	38.5
27-35	444	39.3	529	33.2	973	35.7
36-50	197	17.4	207	13.0	404	14.8
51 +	53	4.7	100	6.3	153	5.6
TOTAL	1129	(*1) 41.5	1593	(*1) 58.5	2722	100.0

(*1) Difference is highly significant

($t = 8.894$, $0.001 > p$).

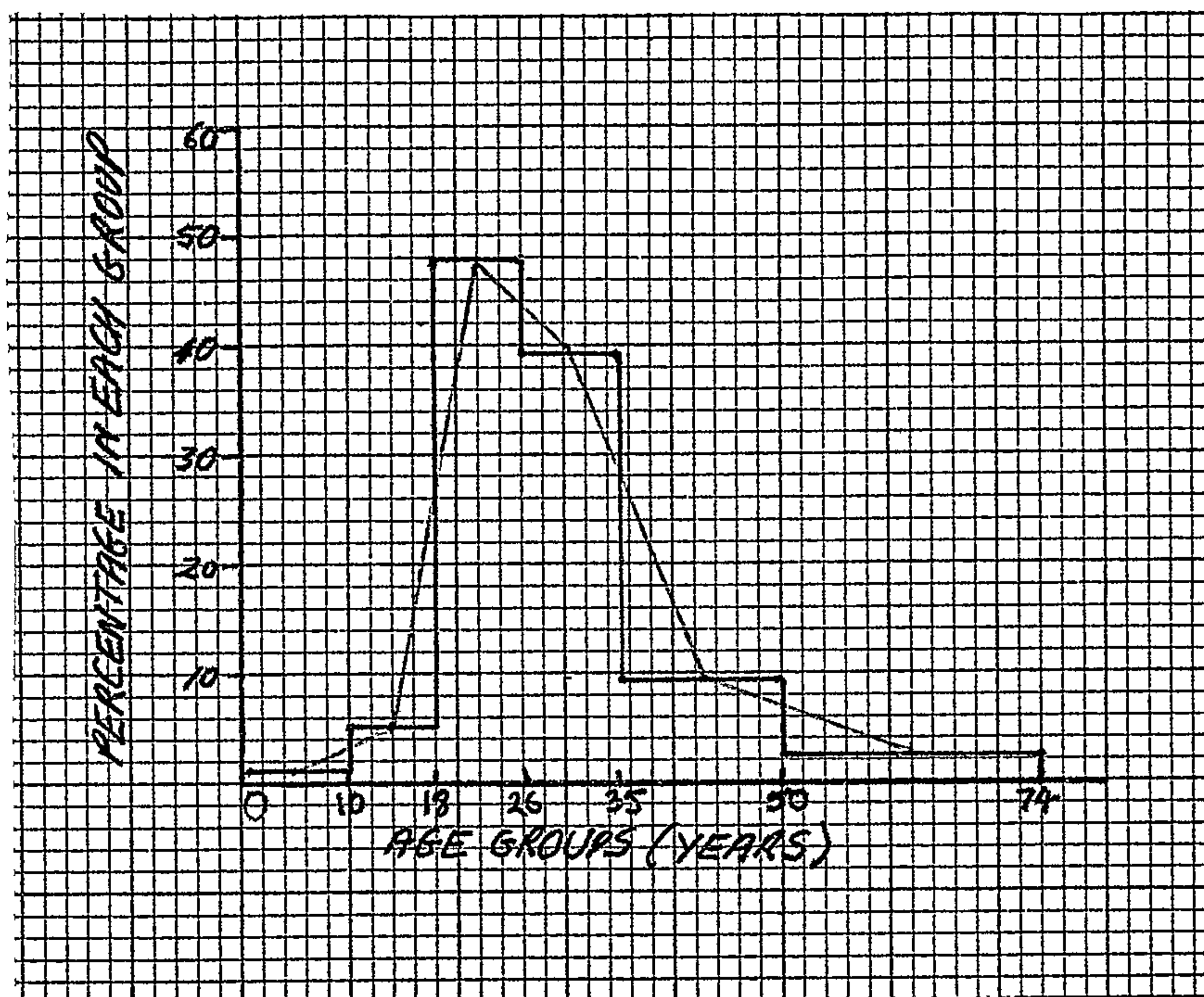
(N.B. These proportions are of the total number.)

(*2) These proportions are of the total for each sex.

TABLE 26-2 YOUNGEST, OLDEST & MEAN AGE (YEARS)			
STATISTIC	MALES	FEMALES	TOTAL
Youngest	4.0	7.0	4.0
Oldest	73.0	74.0	74.0
Mean	30.7	29.9	30.3
Standard Deviation (S.D.)	10.6	11.1	10.9
Median	29.0	27.0	28.0
Mode	26.0	22.0	24.0

DIAGRAM 26-1

HISTOGRAM & FREQUENCY POLYGON OF
AGE DISTRIBUTION OF ALL PATIENTS



$$\text{Skewness} = + 0.617$$

(N.B. Percentages have been adjusted to allow
for different class interval widths)

2-6-2a: Discussion of Age Groups

1. The 0-10 year age group was the smallest, with 24 patients. In selecting patients for this study, I excluded many in this age group because the technique has been shown to be unsuitable in most instances (see Sections 1-5-4h, 1-9-2f).

The patients included in the study in this group all required very easy and simple treatment. Therefore, results concerning patients in this group must be assessed accordingly.

2. The 10-18 year age group was the second smallest group. The same reservations concerning results apply to this group as with the 0-10 age group.
3. The majority of patients were in the 19-26 year and 27-35 year age groups (a total of 74.2%).

2-6-2b: Discussion of Sex Distribution

There are several possible reasons for the significantly higher proportion of females in the study:

1. Females attend more regularly than males. Miller et al (1975) surveyed 236 married couples and found that 47% of females attend regularly whilst only 27% of their husbands did so (a ratio of 1.74:1.0).
2. Females fear dental treatment more than males (Biro & Hewson 1976; Kleinknecht et al 1973) which may explain why females are more likely to seek treatment with sedation or anaesthesia. For example, Donaldson (1970) found that, of patients who required intravenous sedation for conservative dentistry, females outnumbered males 3 to 1. Whilst Hannington-Kiff (1969) surveyed 3,000

patients who attended a hospital for extractions under local analgesia alone, and found that only 38% were females - a ratio of 0.61 to 1.0.

3. Sara (1974) reviewed the literature and calculated that for sedation, females outnumber males in the ratio 1.58 to 1.0. He postulated that females may be more *susceptible to male suggestion* on the part of the dentist.

2-6-2c: Conclusions

1. The study is centred around young adults in the age range, 19-35 years.
2. Females outnumbered males in the ratio 1.41 to 1.0. The higher proportion of females is expected because females attend more regularly and are more likely to request sedatives and anaesthetics. It must be emphasised that no patient was *pressured* into entering the study (see also Section 2-6-4a).

2-6-3: TOTAL NUMBER OF ADMINISTRATIONS

Methohexitone was administered 4,379 times. The age and sex distribution of the administrations is shown in Table 26-3 and Diagram 26-2, and their statistics in Table 26-4.

TABLE 26-3 AGE & SEX DISTRIBUTION FOR ALL ADMINISTRATIONS						
AGE GROUP (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	15	0.8	12	0.5	27	0.6
11-18	61	3.5	113	4.3	174	4.0
19-26	657	37.5	1156	44.0	1813	41.4
27-35	651	37.2	890	33.9	1541	35.2
36-50	285	16.3	306	11.6	591	13.5
51 +	82	4.7	151	5.7	233	5.3
TOTAL	1751	(*1) 40.0	2628	(*1) 60.0	4379	100.0

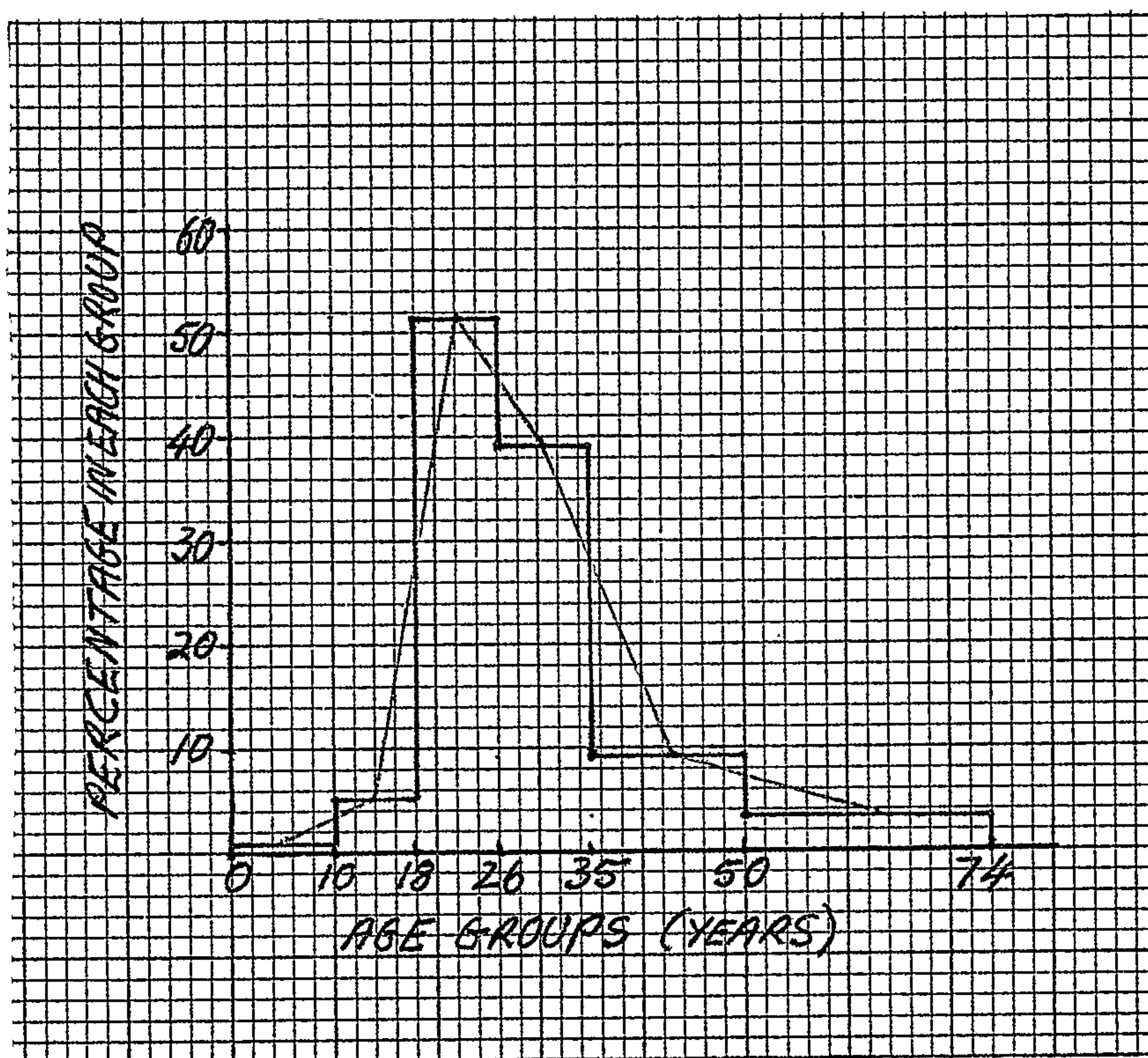
(*1) Difference is highly significant
($t = 13.253$, $0.001 > p$)

TABLE 26-4 MEAN, MEDIAN & MODE (AGE - YEARS) ALL ADMINISTRATIONS			
STATISTIC	MALES	FEMALES	TOTAL
MEAN	(*1) 30.39	(*1) 29.58	29.91
S.D.	10.44	10.72	10.61
MEDIAN	28	27	28
MODE	25	24	23

(*1) The difference may be significant
($t = 2.488$, $0.05 > p > 0.01$)

DIAGRAM 26-2

HISTOGRAM & FREQUENCY POLYGON OF AGE
DISTRIBUTION FOR ALL ADMINISTRATIONS



$$\text{Skewness} = + 0.670$$

(N.B. Percentages have been adjusted to allow for
different class interval widths.)

2-6-3a: Discussion of age groups

1. As would be expected, the 0-10 year age group received the smallest number of administrations.
2. Similarly, the 11-18 year age group received the second smallest number of administrations.
3. The majority of all administrations were given to patients in the 19-26 year and 27-35 year age groups (a total of 76.6%).

2-6-2b: Discussion of sex distribution

The significantly higher proportion of administrations given to females is expected because of the higher proportion available for treatment.

2-6-2c: Conclusions

The sex and age distribution of administrations is not significantly different from the expected.

2-6-4: MULTIPLE ADMINISTRATIONS

2,722 patients received 4,379 administrations of methohexitone. The proportion of patients who received one or more administrations is shown in Table 26-5 and Diagram 26-3.

TABLE 26-5						
PROPORTION OF PATIENTS WHO RECEIVED ONE OR MORE ADMINISTRATIONS OF METHOHEXITONE						
NUMBER OF ADMINISTRATIONS RECEIVED	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
1	765	67.8	1036	65.0	1801	66.2
2	220	19.5	325	20.4	545	20.0
3	91	8.1	118	7.4	209	7.7
4	32	2.9	63	4.0	95	3.5
5 and more (*1)	21	1.7 (*2)	51	3.2 (*2)	72	2.6
Total	1129	100.0	1539	100.0	2722	100.0

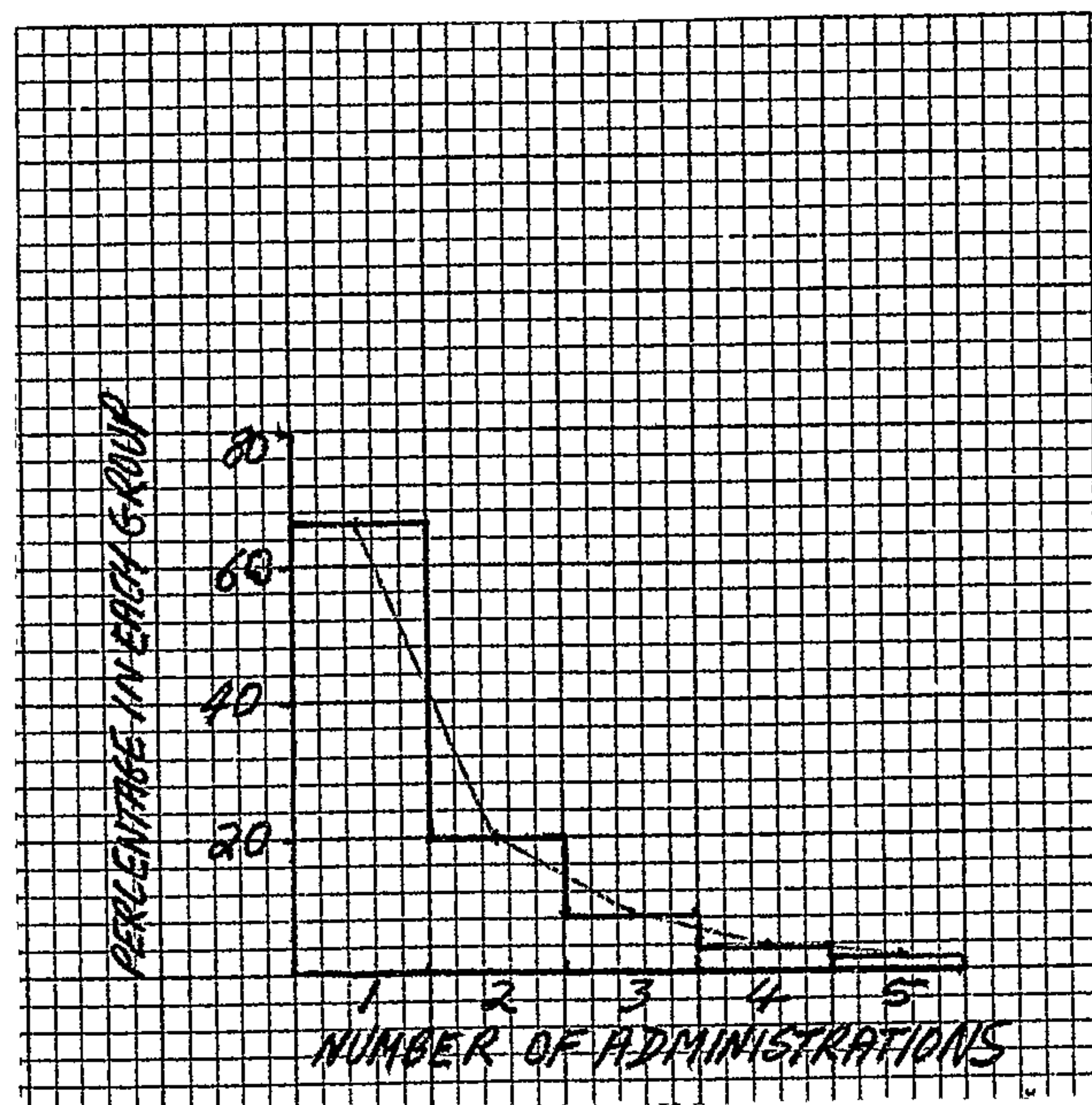
(*1) Maximum = 14 administrations
(9 patients received > 10 administrations)

(*2) Difference may be significant (see Section 2-6-4a)
($t = 2.564$, $0.05 > p > 0.01$)

TABLE 26-6	
	MEAN NO. ADMINISTRATIONS/PATIENT
MALES	1.55
FEMALES	1.65
TOTAL	1.61

DIAGRAM 26-3

HISTOGRAM & FREQUENCY POLYGON OF PROPORTION OF PATIENTS
WHO RECEIVED ONE OR MORE ADMINISTRATIONS



2-6-4a: Discussion of Multiple Administrations

1. If the theory proposed by Sara (1974) is correct, it could be expected that the proportion for males, who received only one administration, would be significantly higher than that for females and the proportions for females, who received two and more administrations, would be significantly higher than that for males (see Section 2-6-2b).

However, there are no such significant differences between the proportions. (In the case of 5 and more administrations, the numbers are too low to attach any real significance.)

2. Three patients from the 0-10 year age group received two administrations whilst the remainder received only one administration.

Similarly, most patients from the 11-18 year age group (73.6%) received only one administration.

2-6-4b: Conclusion

1. Having received methohexitone once, females are no more likely than males to receive methohexitone again for dental treatment.
2. The low frequency of multiple administrations for the 0-10 year and 11-18 year age groups is expected for the reasons given in Section 2-6-2a.

2-6-5: PATIENT APPREHENSION

25 administrations (0.57%) were given to patients who were extremely apprehensive (e.g. adults who were so nervous that venepuncture was almost impossible).

The age and sex distribution is shown in Table 26-7.

TABLE 26-7 AGE & SEX DISTRIBUTION OF ADMINISTRATIONS TO EXTREMELY APPREHENSIVE PATIENTS			
AGE GROUPS (YEARS)	MALES	FEMALES	TOTAL
0-10	-	-	-
11-18	-	-	-
19-26	2	8	10
27-35	3	9	12
36-50	1	2	3
51 +	-	-	-
Total	6	19	25

2-6-5a: Discussion of Patient Apprehension

More administrations were given to extremely anxious females than to their male counterparts (ratio 3.17:1).

The difference is expected because of the higher proportion of females in the study and is in keeping with the discussion of fear in Section 2-2-2b. However, because of the small number of administrations given to extremely anxious patients, the difference is not statistically significant.

2-6-5b: Conclusion

Apprehension is difficult to gauge (see Section 2-5-1), however a small proportion of patients were highly apprehensive, as to be quite obvious.

2-6-6: HEALTH STATUS OF PATIENTS

Methohexitone was not administered to any patient whose medical condition was an absolute contraindication.

146 medical conditions were recorded in 122 administrations. A detailed breakdown is presented in Table 26-8.

TABLE 26-8: DISTRIBUTION OF MEDICAL CONDITIONS							
MEDICAL CONDITION	A G E G R O U P S (Y E A R S)						TOTAL
	0-10	11-18	19-26	27-35	36-50	51 +	
Up to 3 months pregnant				1			1
3-6 months pregnant			3	1			4
6-9 months pregnant			2	1			3
Cardiovascular				2	2	3	7
Respiratory			4	4			8
Heavy Smoker			8	10	5	2	25
Asthmatic		1	14	5	3		23
Drug Allergy							-
Prescribed Drugs			16	15	9	4	44
Methadone			4	2			6
Hepatitis			1	1			2
Liver							-
Epileptic			5		1		6
Other			4	7	5	1	17
TOTAL	0	1	61	49	25	10	146

2-6-6a: Discussion

There was no more significant change in the age and sex distribution of administrations to patients with a medical condition than would be expected.

2-6-7: PATIENT WEIGHT

Thirtyseven administrations (0.85%) were given to patients with a heavy muscular build. The age and sex distribution is presented in Table 26-8.

TABLE: 26-8 AGE & SEX DISTRIBUTION OF ADMINISTRATIONS TO PATIENTS WITH A HEAVY MUSCULAR BUILD			
AGE GROUP (YEARS)	MALES	FEMALES	TOTAL
0-10	-	-	-
11-18	1	-	1
19-26	13	2	15
27-35	13	-	13
36-50	8	-	8
51 +	-	-	-
Total	35	2	37

2-6-7a: Discussion of Patient Weight

1. Weight is a poor guide to dosage requirements, particularly when an incremental technique is used, therefore patients were not weighed. (See Sections 1-5-3 and 1-5-4.)

2. As patients of a heavy muscular build may require higher dosages, a record was made in such cases. As would be expected, most administrations in this category were given to males aged 19-35 years.

2-7

TYPES OF TREATMENT

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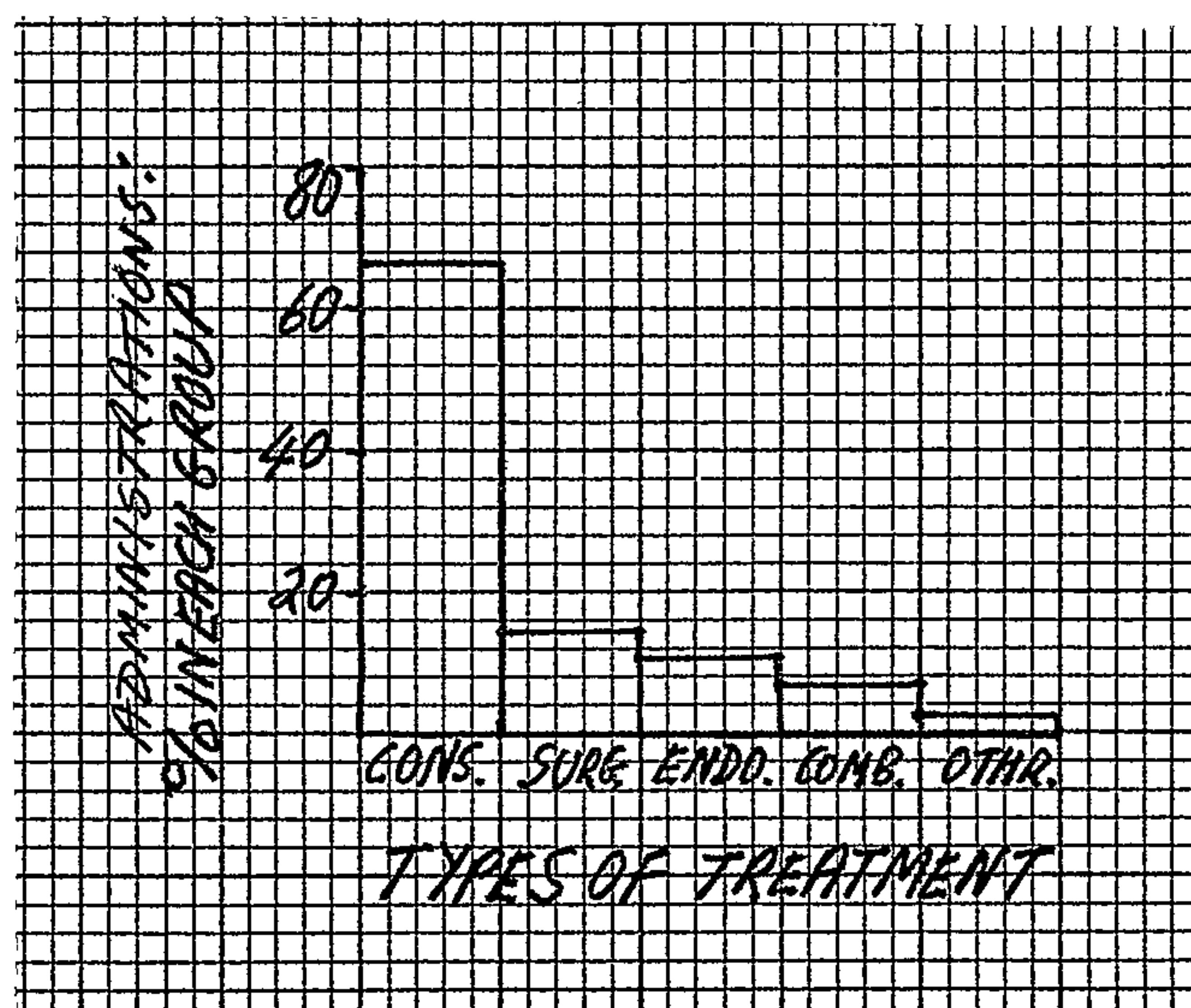
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2-7: TYPES OF TREATMENT

The distribution of the different types of treatment completed for each administration is presented in Table 27-1 and Diagram 27-1, but only the results for conservation, surgery and endodontics are analysed.

TABLE 27-1 DISTRIBUTION OF TYPES OF TREATMENT		
TYPE OF TREATMENT	ADMINISTRATIONS	
	Frequency	% of Total
Conservation	2,883	65.8
Surgery	690	15.8
Endodontics	456	10.4
Combinations	265	6.1
Other	85	1.9
TOTAL	4,379	100.0

DIAGRAM 27-1: BAR CHART OF DISTRIBUTION OF TYPES OF TREATMENT



2-7-1: CONSERVATION (Excluding Endodontics)

The age and sex distribution of patients who received administrations for conservation is shown in Table 27-2, and statistics in Table 27-3.

TABLE 27-2 AGE & SEX DISTRIBUTION ADMINISTRATIONS FOR CONSERVATION* ¹						
AGE GROUPS (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	1	0.1	3	0.2	4* ²	0.1
11-18	41	3.6	79	4.5	120	4.2
19-26	416	36.7	747	42.7	1163	40.3
27-35	440	38.8	623	35.6	1063	36.9
36-50	187	16.5	221	12.6	408	14.2
51 +	49	4.3	76	4.3	125* ³	4.3
TOTAL	1134	39.3	1749	60.7	2883	100.0

*¹ The observed frequencies were compared to the expected frequencies (calculated from proportions in Table 26-3). The difference is probably significant, ($\chi^2 = 14.398$, $0.02 > p > 0.01$).

*² Less than expected; difference significant - ($\chi^2 = 10.225$, $0.01 > p > 0.001$).

*³ Less than expected; difference may be significant - ($\chi^2 = 5.058$, $0.05 > p > 0.02$).

TABLE 27-3 MEAN AGE OF PATIENTS WHO RECEIVED ADMINISTRATIONS FOR CONSERVATION			
	MALES	FEMALES	TOTAL
Mean Age (years)	30.56*	29.42*	29.87
S.D. (years)	10.04	10.02	10.04

* Difference is significant

($t = 2.977$, $0.01 > p > 0.001$)

An analysis of the types of treatment completed in this category is shown in Table 27-4.

TABLE 27-4 ANALYSIS OF CONSERVATION	
DETAILS	PERCENTAGE OF ADMINISTRATIONS
Simple* Restorations	88.5
Crown & Bridgework	9.7
Deep or Large Restorations	1.8
Total	100.0

* Mean/administration = 2.48 restorations (± 1.81)

2-7-1a: Discussion of Conservation

1. 65.8% of administrations were for conservation excluding endodontics. If endodontics is included, the proportion becomes 76.2% which supports the estimate of Beesley et al (1969) that administrations for conservation are given three times more than for other treatments (see Section 1-4-2a).
2. The 0-10 year age group received less administrations than expected because the patients in this group who required multiple restorations were not treated by the M.I.T.
3. Less administrations than expected were given to the 51+ year group. The difference for males was not significant but was for females ($\chi^2 = 5.634$, $0.02 > p > 0.01$) and accounts for the lower mean age of females.

Less conservation work is needed in this age group so that the reductions are not surprising.
4. The figures in Table 27-4 support the practicality of the recommendations of Bourne (1969b, 1974b) who said that the M.I.T. should be reserved for dentistry that is not difficult.

2-7-1b: Conclusion

1. Most administrations for conservation were given to patients aged 19-35 years.
2. Most administrations for conservation were for simple restorations (usually 1-4 per session).

2-7-2: ORAL SURGERY

The age and sex distribution of patients who received administrations for oral surgery is shown in Table 27-5, the statistics in Table 27-6 and analysis of types of treatment in Table 27-7.

TABLE 27-5 AGE & SEX DISTRIBUTION ADMINISTRATIONS FOR ORAL SURGERY* ¹						
AGE GROUPS (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	14	4.3	9	2.5	23* ⁴	3.3
11-18	16	4.9	19	5.2	35	5.1
19-26	130	39.6	162	44.8	292	42.3
27-35	85	25.6	94	26.0	179* ⁶	25.9
36-50	57	17.4	36	9.9	93	13.5
51 +	26	7.9	42	11.6	68* ⁵	9.9
TOTAL	328* ³	47.5	362* ³	52.5* ²	690	100.0

*¹ Highly significant difference to the expected
($\chi^2 = 132.996$, $0.001 > p$)

*² Less than % for conservation. Difference is significant
($t = 2.854$, $0.01 > p > 0.001$)

*³ More males, less females than expected. Highly significant
difference to expected ($\chi^2 = 16.328$, $0.001 > p$)

*⁴ More than expected. Highly significant ($\chi^2 = 87.124$, $0.001 > p$)

*⁵ More than expected. Highly significant ($\chi^2 = 26.939$, $0.001 > p$)

*⁶ Less than expected. Highly significant ($\chi^2 = 16.810$, $0.001 > p$)

TABLE 27-6 MEAN AGE OF PATIENTS WHO RECEIVED ADMINISTRATIONS FOR ORAL SURGERY			
	MALES	FEMALES	TOTAL
Mean age (years)	30.22	30.42	30.32
S.D.	13.07	13.63	13.33

TABLE 27-7 ANALYSIS OF ORAL SURGERY	
DETAILS	PERCENTAGE OF ADMINISTRATIONS
Simple Extractions*	81.4
Surgical Extractions	10.9
Surgical (third molar) Extractions	6.7
Other Surgery	1.0
Total	100.0

* Single extraction in 76.9% of all simple extractions

2-7-2a: Discussion of Oral Surgery

1. Less administrations were given to females for oral surgery than expected. This is a reflection of better dental health among females (see Section 2-6-2b).

2. Because restorative work was avoided in the 0-10 year age group, the proportion of administrations for oral surgery is greater than expected.
3. More administrations were given to the 51+ year age group than expected. This is not surprising because of the effect of periodontal disease in older patients.
4. The reduction in administrations to the 27-35 year group, compared to the expected, reflects the greater desire of patients in this age group to conserve teeth.

2-7-2b: Conclusions

1. Most administrations for oral surgery were given to patients aged 19-35 years.
2. Most administrations for oral surgery were for simple, single extractions.

2-7-3: ENDODONTICS

The age and sex distribution of patients who received administrations for endodontics is shown in Table 27-8, the statistics in Table 27-9 and analysis of types of treatment in Table 27-10.

TABLE 27-8						
AGE & SEX DISTRIBUTION ADMINISTRATIONS FOR ENDODONTICS						
AGE GROUPS (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	-	-	-	-	-	-
11-18	2	1.3	10	3.3	12	2.6
19-26	65	42.2	148	49.0	213	46.7
27-35	64	41.6	97	32.1	161	35.3
36-50	18	11.7	27	8.9	45	9.9
51 +	5	3.2	20	6.6	25	5.5
Total	154 (*3)	33.8	302 (*3)	66.2 (*1)(*2)	456	100.0

*1 Higher % than for conservation. Difference significant
($t = 2.962$, $0.01 > p > 0.001$)

*2 Higher % than for surgery. Difference highly significant
($t = 3.623$, $0.001 > p$)

*3 Less males, more females than expected. Significant
($\chi^2 = 7.370$, $0.01 > p > 0.001$)

TABLE 27-9			
MEAN AGE OF PATIENTS WHO RECEIVED ADMINISTRATIONS FOR ENDODONTICS			
	MALES	FEMALES	TOTAL
Mean Age (years)	29.59	29.38	29.45
S.D.	8.92	10.86	10.20

TABLE 27-10 ANALYSIS OF ENDODONTICS	
DETAILS	% OF ADMINISTRATIONS
Dressings	51.4
Vital Pulpectomy	44.8
Establish Drainage - Acute Abscess	3.8
Total	100.0

2-7-3a: Discussion of Endodontics

1. The high proportion of females, compared to the expected, is a reflection of the greater desire of females to conserve teeth compared to that of males.
2. 48.6% of the administrations were given for emergency treatment - pulpectomies and drainage.

2-7-3b: Conclusions

1. Most administrations for endodontics were given to patients aged 19-35 years.
2. Administrations were almost equally divided between emergency treatment and elective treatment (dressings).

2-7-4: CONCLUSIONS

1. Simple procedures comprised the bulk of the work completed - one or two restorations, a simple extraction, or endodontics.
2. Combinations or complex treatment comprised a small proportion of work and therefore, were not analysed.
3. Most administrations given to children (0-10 years) were for emergency extractions.

2-8

DURATION OF TREATMENT

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2-8: DURATION OF ADMINISTRATIONS

Details of measurement are given in section 2-4-1c(ii).

2-8-1: AGE GROUP DISTRIBUTION

The statistics are presented in Table 28-1.

TABLE 28-1 DURATION OF TREATMENT (MINUTES) AGE GROUPS				
AGE GROUP (YEARS)	RANGE	MEAN	S.D	NUMBER OF ADMINISTRATIONS
0-10	5- 10	6* ¹	2.83	27
11-18	5- 60	18* ²	12.57	174
19-26	5- 90	21* ³	13.00	1813
27-35	5-120	21* ⁴	15.13	1541
36-50	5-240	23* ³ * ⁴	19.49	591
51 +	5- 90	18	14.97	233
Total	5-240	21	14.80	4379

*¹ Less than all other groups. Highly significant ($0.001 > p$, t values respectively = 10.929, 24.038, 22.489, 17.544, 9.836)

*² Less than most other groups: differences significant ($0.01 > p > 0.001$) for 19-26 and 27-35 year groups (t values = 2.997, 2.918 respectively). Difference highly significant for 36-50 year group ($t = 4.016$, $0.001 > p$)

*³ Difference may be significant ($t = 2.331$, $0.05 > p > 0.01$)

*⁴ Difference may be significant ($t = 2.247$, $0.05 > p > 0.01$)

2-8-1a: Discussion of Duration and Age Groups

1. The low mean duration for the 0-10 year age group is a result of the type of treatment received - simple extractions mainly (see Table 27-5 and Table 28-2).
2. The low mean duration for the 11-18 year group cannot be explained in terms of types of treatment because there was no difference, compared to the expected, in the distribution of treatment types to this group (see Tables 27-2, 27-5 and 27-8). It does however, reflect the selection of patients in this group. Treatment was limited to simple conservation and surgery.
3. The higher mean duration for the 36-50 year old group cannot be explained in terms of types of treatment (as for (2) above). It does however, reflect the fact that patients in this group have significantly less operating complications (see Section 2-11-2, Table 211-12) and therefore, work of longer duration can be undertaken.
4. The shorter mean time for the 51+ year age group is a result of more administrations for oral surgery than expected (see Table 27-5), and less administrations for conservation than expected (see Table 27-2).

2-8-1b: Conclusion

Differences in treatment time for the different age groups is related to differences in types of treatment or degrees of difficulty of treatment.

2-8-2: TYPES OF TREATMENT

The statistics are presented in Table 28-3 and Diagram 28-1.

TABLE 28-2 DURATION OF TREATMENT (MINUTES) TYPES OF TREATMENT				
TYPE OF TREATMENT	RANGE	MEAN	S.D	NUMBER OF ADMINISTRATIONS
Combined	5- 90	32* ¹	13.42	265
Conservation	5-240	24* ¹ _{*2}	15.72	2883
Endodontics	5- 30	14* ² _{*3}	5.29	456
Other	5- 60	11* ⁴ _{*3}	10.25	85
Surgery	5- 60	8* ⁴	7.4	690
Total	5-240	21	14.80	4379

*¹ Difference highly significant ($t = 9.142, 0.001 > p$)

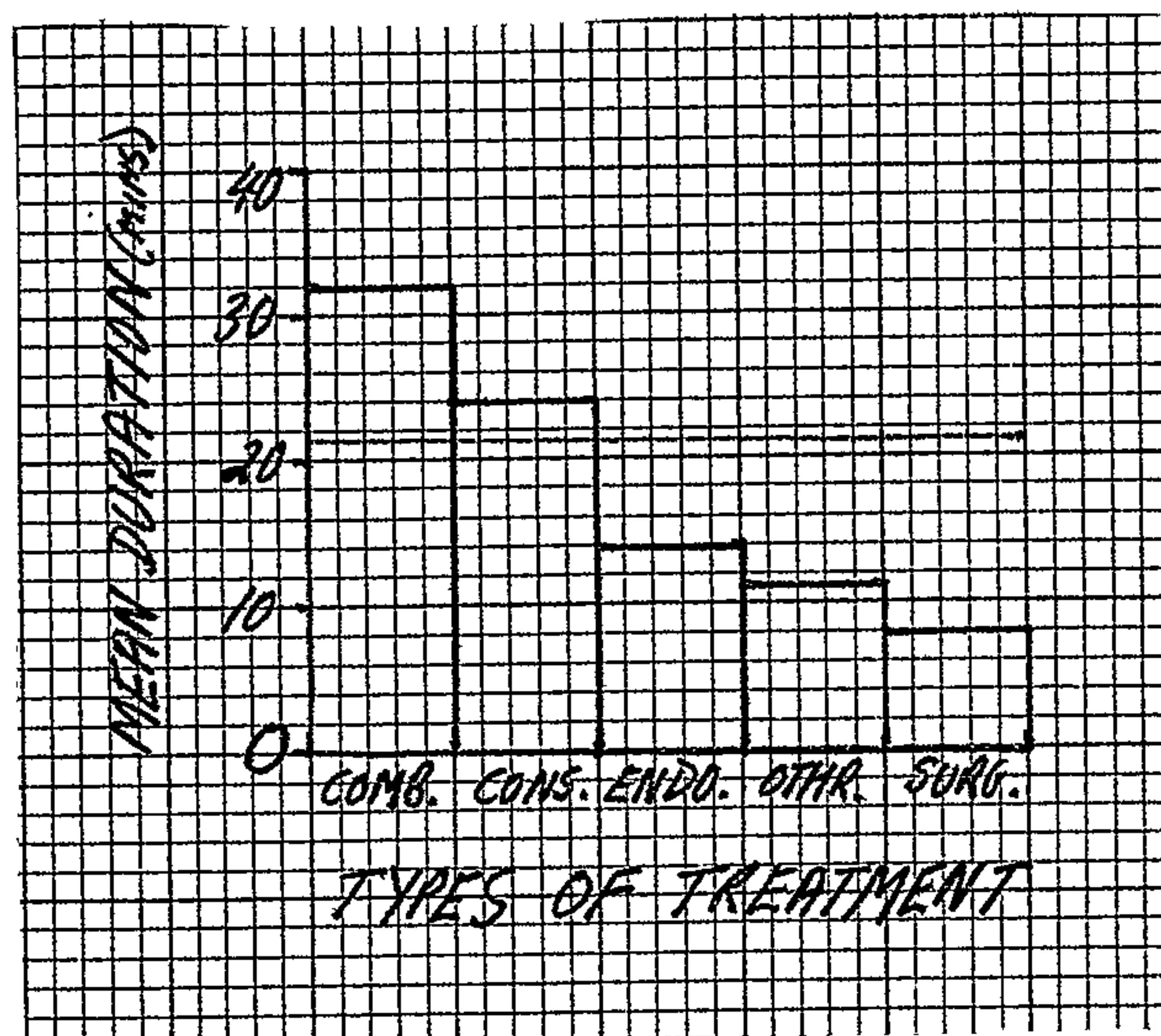
*² Difference highly significant ($t = 26.042, 0.001 > p$)

*³ Difference significant ($t = 2.634, 0.01 > p > 0.001$)

*⁴ Difference significant ($t = 2.616, 0.01 > p > 0.001$)

DIAGRAM 28-1

BAR CHART OF MEAN DURATIONS OF TYPES OF TREATMENT



Overall Mean (21mins) _____

2-8-3: DISCUSSION OF MEAN DURATION

The maximum recommended times of duration are 20 minutes for conservation and 10 minutes for surgery. These times are measured from induction to last increment of methohexitone.

I measured duration as the time from induction with methohexitone till completion of treatment - which is a longer time and accounts for the longer times recorded.

2-8-4: CONCLUSIONS

The mean durations of treatment fall within the recommended maximum treatment times.

2-9

DRUGS USED TO SUPPLEMENT METHOHEXITONE

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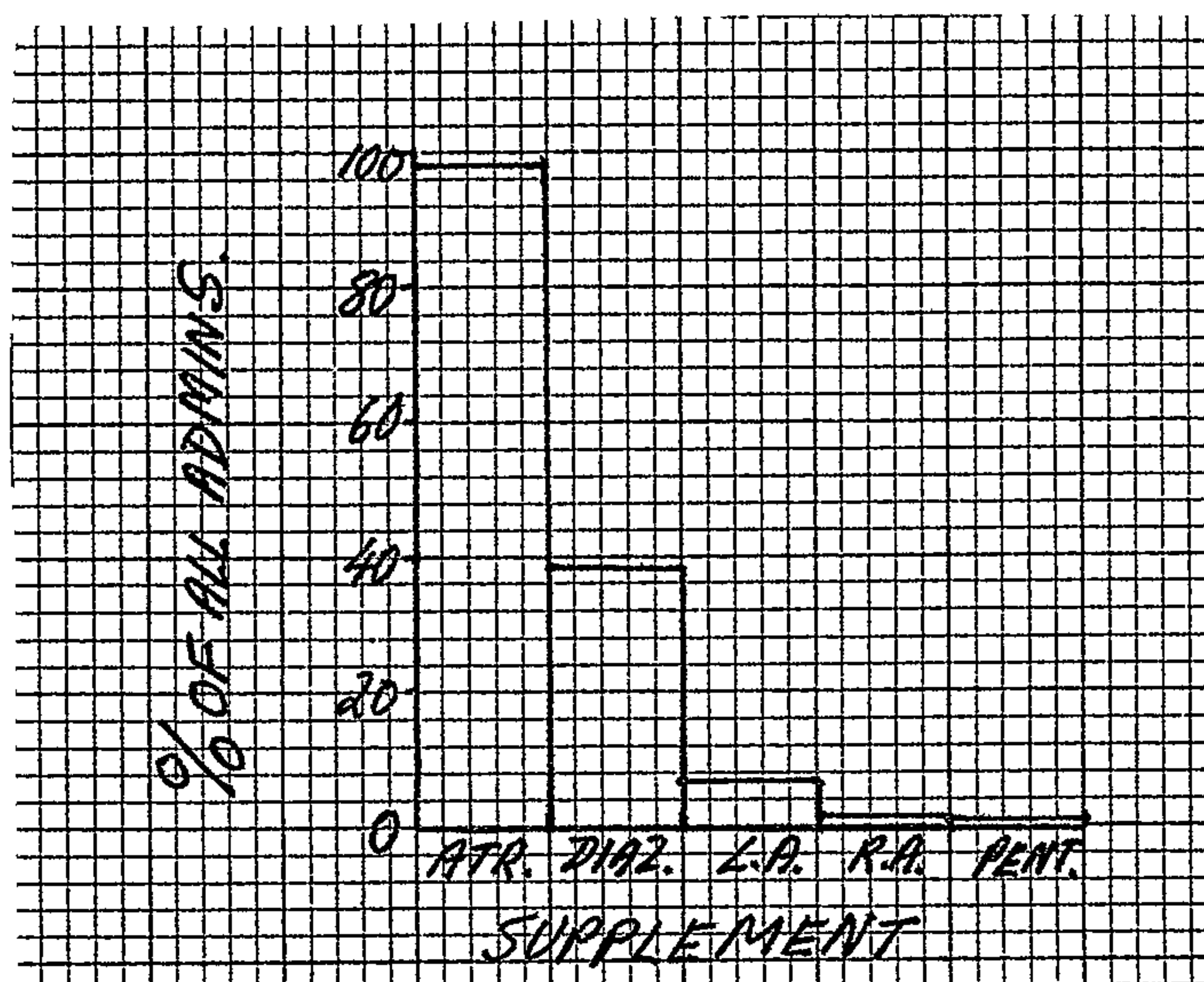
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2-9: DRUGS USED TO SUPPLEMENT METHOHEXITONE

The drugs and the frequency of their use are shown in Table 29-1 and Diagram 29-1. Only atropine, diazepam and local analgesia supplementation are analysed (see Sections 2-9-1 to 2-9-4).

TABLE 29-1 FREQUENCY OF SUPPLEMENTATION			
SUPPLEMENT	NUMBER OF ADMINISTRATIONS		
	WITHOUT	WITH	% OF TOTAL WITH
Atropine	73	4306	98.3
Diazepam	2716	1663	38.0
Local Analgesia	4036	343	7.8
Relative Analgesia	4363	16	0.4
Pentazocine	4376	3	0.07

DIAGRAM 29-1
BAR CHART OF % FREQUENCY OF SUPPLEMENTATION



2-9-1: ATROPINE

0.6mg atropine was used routinely as an antisialogogue. In four administrations, 1.2mg was used because of excessive salivation.

Atropine was not used if the procedure was expected to be very brief.

Because the number of administrations supplemented with atropine

is 98.3% of all administrations, more information is gained by examining those administrations without atropine.

1.7% of all administrations of methohexitone was given without atropine supplementation. The age and sex distribution is shown in Table 29-2 and statistics in Table 29-3.

TABLE 29-2 AGE & SEX DISTRIBUTION FOR ADMINISTRATIONS WITHOUT ATROPINE						
AGE GROUP (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	8	20.5	2	5.9	10* ¹	13.7
11-18	4	10.3	2	5.9	6	8.2
19-26	6	15.4	16	47.1	22	30.1
27-35	15	38.4	7	20.5	22	30.1
36-50	5	12.8	3	8.8	8	11.0
51 +	1	2.6	4	11.8	5	6.9
TOTAL	39	53.4	34	46.6* ²	73	100.0

*¹ Higher than the expected (calculated from proportion in Table 26-3). Difference highly significant ($\chi^2 = 230.400$, $0.001 > p$)

*² Compared to proportion of administrations with atropine (60.2%) - difference may be significant ($t = 2.311$, $0.05 > p > 0.01$)

TABLE 29-3 MEAN AGE OF PATIENTS WHO RECEIVED ADMINISTRATIONS WITHOUT ATROPINE			
	MALES	FEMALES	TOTAL
Mean Age (Years)	24.99*	29.15	29.93
S.D.	13.74	14.66	14.23

TABLE 29-4 MEAN AGE OF PATIENTS WHO RECEIVED ADMINISTRATIONS WITH ATROPINE			
	MALES	FEMALES	TOTAL
Mean age (years)	30.52*	29.59	29.96
S.D.	10.33	10.66	10.54

* (for Tables 29-3 and 29-4)

Difference may be significant. ($t = 2.498$, $0.05 > p > 0.01$)

2-9-1a: Discussion of Administrations without Atropine

1. The higher proportion of males and the high relative frequency for the 0-10 year age group are a reflection of the type of treatment when atropine was not given - simple extractions.
2. The lower mean age of males who did not receive atropine is due to the high frequency of administrations in the 0-10 year age group.

2-9-1b: Conclusion

1. Atropine was used routinely unless I was very confident that a procedure was to be so quick that its use was not warranted.
2. Children (0-10 years) were given methohexitone only for simple, brief procedures and this is reflected in the relatively high number of administrations without atropine to this group.

2-9-2: DIAZEPAM

The method of supplementation is discussed in Section 2-3-5.

Diazepam was used in the hope that it would help to:

1. Reduce dosage of methohexitone for long or difficult procedures.
2. Provide better working conditions in patients who were previously restless on methohexitone alone.

The age and sex distribution for administrations without diazepam (Tables 29-1, 29-2) and with diazepam (Tables 29-3, 29-4) are compared.

TABLE 29-3 ADMINISTRATIONS WITHOUT DIAZEPAM						
AGE GROUPS (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	14	1.3	12	0.7	26	1.0
11-18	48	4.4	69	4.2	117	4.3
19-26	389	35.8	685	42.1	1074	39.6
27-35	406	37.3	570	35.0	976	35.9
36-50	174	16.0	183	11.2	357	13.1
51 +	56	5.2	110	6.8	166	6.1
Total	1087	40.0	1629	60.0	2716	100.0

(For significant differences, see Table 29-5)

TABLE 29-4 MEAN AGE ADMINISTRATIONS WITHOUT DIAZEPAM			
	MALES	FEMALES	TOTAL
Mean age (years)	30.39	29.94	30.12
S.D.	10.83	11.17	11.04

TABLE 29-5 ADMINISTRATIONS WITH DIAZEPAM* ¹						
AGE GROUP (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	1	0.2	-	0	1* ²	0.1
11-18	13* ³	1.9	44	4.4	57	3.4
19-26	268	40.4	471	47.2	739* ⁴	44.4
27-35	245	36.9	320	32.0	565	34.0
36-50	111	16.7	123	12.3	234	14.1
51 +	26	3.9	41	4.1	67* ⁵	4.0
Total	664	39.9	999	60.1	1663	100.0

Compared to distribution without diazepam (Table 29-3):

*¹ Difference highly significant ($\chi^2 = 31.631$, $0.001 > p$)

*² Less than expected. Difference highly significant
($\chi^2 = 13.45$, $0.001 > p$)

*³ Less than expected. Difference is significant
($\chi^2 = 7.146$, $0.01 > p > 0.001$)

*⁴ More than expected. May be significant
($\chi^2 = 5.967$, $0.02 > p > 0.01$)

*⁵ Less than expected. Difference significant
($\chi^2 = 8.415$, $0.01 > p > 0.001$)

TABLE 29-6 MEAN AGE ADMINISTRATIONS WITH DIAZEPAM			
	MALES	FEMALES	TOTAL
Mean Age (Years)	30.41* ¹	29.00* ¹ _{*²}	29.56
S.D.	9.79	9.90	9.88

*¹ Difference is significant
($t = 2.866$, $0.01 > p > 0.001$)

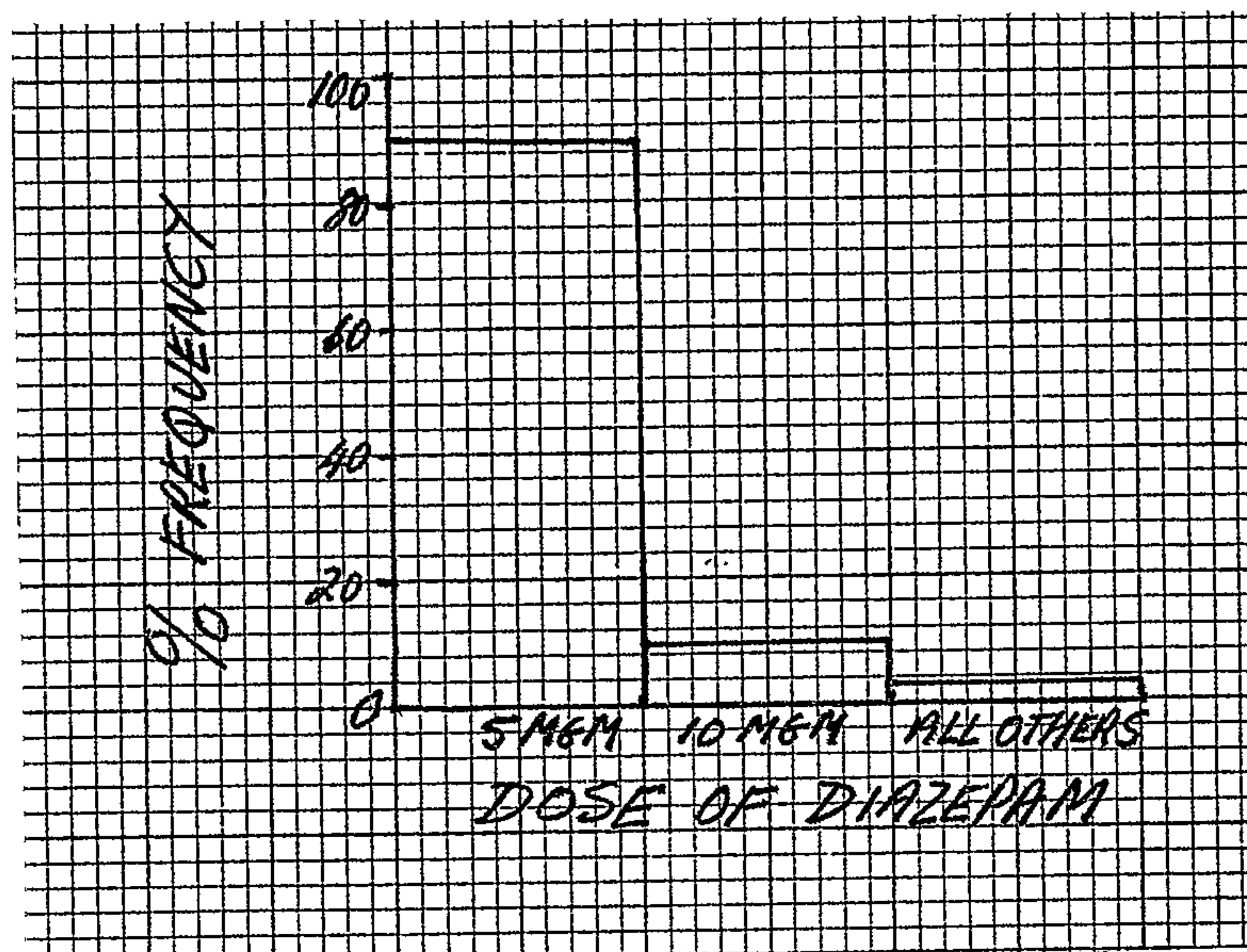
*² Less than for administrations without diazepam.
Difference may be significant
($t = 2.249$, $0.05 > p > 0.01$)

TABLE 29-7 DOSAGE OF DIAZEPAM		
DOSE (MG) USED*	ADMINISTRATIONS NO %	
2.5	25	1.5
5.0	1467	88.2
7.5	14	0.8
10.0	142	8.6
12.5	1	0.1
15.0	7	0.4
20-25	7	0.4
Total	1663	100.0

* Mean = 5.52mg (SD = 1.88mg)

DIAGRAM 29-2

BAR CHART OF % FREQUENCIES OF
DIFFERENT DOSAGES OF DIAZEPAM



2-9-2a: Discussion of Diazepam Supplementation

1. More administrations were given to younger females than expected (see Table 29-6).
2. The differences in the observed frequencies, compared to the expected, in the age group distribution (Table 29-5) is explained by the type of treatment received by the age groups concerned:
 - (i) 0-10 years - simple extractions. In these cases, diazepam may give unpredictable results (see Section 1-11-6h(iv)).

- (ii) 11-18 years - long treatments avoided.
 - (iii) 51+ years - simple extractions.
3. The mean dose is low compared to Southwell (1975), but similar to that used by others (see Section 1-11-6h(vii)).

2-9-2b: Conclusion

1. Most administrations supplemented with diazepam were given to patients aged 19-35 years.
2. In 96.8% of supplemented administrations, either 5 or 10mg was used.

2-9-3: LOCAL ANALGESIA

The method of supplementation is discussed in Section 2-3-9.
Local analgesia was used to:

1. Reduce dosage of methohexitone in long or painful procedures (e.g. crown preparations or surgical extractions).
2. To improve bad working conditions (e.g. restlessness).

The age and sex distribution is shown in Table 29-8 and the statistics in Table 29-9.

TABLE 29-8						
AGE & SEX DISTRIBUTION ADMINISTRATIONS WITH LOCAL ANALGESIA						
AGE GROUP (YEARS)	MALES		FEMALES		TOTAL	
	NO	%	NO	%	NO	%
0-10	-	-	1	0.6	1	0.3
11-18	5	2.8	10	6.2	15	4.4
19-26	63	34.8	82	50.6	145	42.2
27-35	72	39.8	45	27.8	117	34.1
36-50	35	19.3	15	9.3	50	14.6
51 +	6	3.3	9	5.5	15	4.4
Total	181	52.8	162	47.2* ¹	343	100.0

*¹ Less than % for administrations without local analgesia - (61.0%). Difference highly significant ($t = 3.438$, $0.001 > p$)

TABLE 29-9			
MEAN AGE OF PATIENTS ADMINISTRATIONS WITH LOCAL ANALGESIA			
	MALES	FEMALES	TOTAL
Mean Age (Years)	30.92* ¹	28.32* ¹	26.69
S.D.	9.58	10.78	10.23

*¹ Difference may be significant ($t = 2.349$, $0.05 > p > 0.01$)

2-9-3a: Discussion

More administrations supplemented with local analgesia were given to males. This is because males are more restless than females (see Section 2-11-2, Table 211-12), and because of the relatively high frequency of administrations for oral surgery requiring local analgesia (e.g. retained roots, etc.).

2-9-3b: Conclusion

Most administrations supplemented by local analgesia are given to patients aged 19-35 years.

2-9-4: CONCLUSIONS

1. Most administrations given to the 0-10 year group were unsupplemented.
2. Most administrations given to the 51+ year group were unsupplemented.
3. Males in the 11-18 year age group received more unsupplemented administrations than expected.
4. These results reflect the nature of the treatment received by the age groups concerned.

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2-10: DOSAGE OF METHOHEXITONE

The method of recording total dosage of each administration is discussed in Section 2-4-1c(i).

2-10-1: WHOLE STUDY

The statistics are presented in Table 210-1.

TABLE 210-1 MEAN TOTAL DOSAGE METHOHEXITONE WHOLE STUDY (MG)			
	MALES	FEMALES	TOTAL
Lowest	20	20	20
Highest* ²	500	560	560
Mean	158* ¹	147* ¹	151
S.D.	70.67	62.99	67.02
NUMBER OF ADMINISTRATIONS	1751	2628	4379

*¹ Difference highly significant ($t = 5.266$, $0.001 > p$)

*² Less than 280mg in 95% of administrations
Less than 200mg in 77% of administrations

2-10-1a: Discussion

1. The results may be compared with those of other studies of the M.I.T. shown in Table 5-9 (Section 1-5-10a). Whilst many studies report a similar range, only four studies report a mean total dose less than 151mg.

2. The mean total dose is below the recommended maximum of 200mg (see Section 1-5-10b).
3. The results confirm the finding of others that males require higher doses than females (see Section 1-5-4c).

2-10-1b: Conclusion

In practice, it should be possible to keep total dosage within the recommended limits (see Section 1-5-10c).

2-10-2: ADMINISTRATIONS WITHOUT DIAZEPAM OR LOCAL ANALGESIA SUPPLEMENTATION

The statistics are presented in Table 210-2.

TABLE 210-2 MEAN TOTAL DOSAGE (MG) METHOHEXITONE WITHOUT DIAZEPAM OR L.A			
	MALES	FEMALES	TOTAL
Lowest	60	40	40
Highest* ²	500	380	500
Mean	137* ¹	129* ¹	132
S.D.	51.50	47.09	49.44
Number of Administrations	1034	1589	2623

*¹ Difference highly significant ($t = 4.020$, $0.001 > p$)

*² Less than 230mg in 95% of administrations

The statistics for each age group are presented in Tables 210-3, 210-4, 210-5, 210-6, 210-7, 210-8 and Diagram 210-1.

TABLE 210-4			
0-10 YEAR AGE GROUP			
MEAN TOTAL DOSAGE (MG)			
ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A.			
	MALES	FEMALES	TOTAL
Lowest	60	60	60
Highest	100	100	100
Mean	71	87	78*
S.D.	18.17	22.45	21.82
Number of Administrations	14	11	25

* Lower than for all other age groups. Differences are all highly significant ($0.001 > p$; respective values for $t = 8.478, 13.011, 12.202, 9.108, 5.386$)

TABLE 210-5			
11-18 YEAR AGE GROUP			
MEAN TOTAL DOSAGE (MG)			
ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A.			
	MALES	FEMALES	TOTAL
Lowest	60	60	60
Highest	240	260	260
Mean	130	128	129*
S.D.	45.31	43.94	44.05
Number of Administrations	47	66	113

* See p.413

From Table 210-5:

- * Higher than 0-10 year group. Difference highly significant ($t = 8.478$, $0.001 > p$)
- * Higher than 51+ year group. Difference highly significant ($t = 3.889$, $0.001 > p$)
- * Lower than 19-26 year group. Difference may be significant ($t = 2.044$, $0.05 > p > 0.02$)

TABLE 210-6			
19-26 YEAR AGE GROUP			
MEAN TOTAL DOSAGE (MG)			
ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A			
	MALES	FEMALES	TOTAL
Lowest	80	60	60
Highest* ³	400	380	400
Mean	145* ¹	133* ¹	138* ²
S.D.	55.43	46.28	48.06
Number of Administrations	371	668	1039

*¹ Difference highly significant ($t = 3.541$, $0.001 > p$)

*² Higher than 0-10 year, 36-50 year and 51+ year groups. Differences all highly significant ($0.001 > p$, respective values for $t = 13.011$, 5.444 , 7.960)

*² Higher than 11-18 year group. Difference probably significant ($t = 2.044$, $0.05 > p > 0.02$)

*³ Less than 230mg in 95% of administrations

TABLE 210-7 27-35 YEAR AGE GROUP MEAN TOTAL DOSAGE (MG) ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A.			
	MALES	FEMALES	TOTAL
Lowest	60	60	60
Highest* ³	500	340	500
Mean	140* ¹	132* ¹	135* ²
S.D.	53.05	48.46	51.22
Number of Administrations	385	560	945

*¹ Difference may be significant

($t = 2.359$, $0.05 > p > 0.01$)

*² Higher than 0-10 year, 36-50 year and 51+ year groups. Differences all highly significant

($0.001 > p$, respective values for $t = 12.202$, 4.205, 7.028)

*³ Less than 240mg in 95% of administrations

TABLE 210-8 36-50 YEAR AGE GROUP MEAN TOTAL DOSAGE (MG) ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A.			
	MALES	FEMALES	TOTAL
Lowest	80	40	40
Highest* ²	220	300	300
Mean	125	122	123* ¹
S.D.	40.89	42.23	42.91
Number of Administrations	165	178	343

*¹ Higher than 0-10 year and 51+ year groups. Both differences highly significant ($0.001 > p$, respective values for $t = 9.108, 3.601$)

*¹ Lower than 19-26 year and 27-35 year groups. Both differences highly significant ($0.001 > p$, respective values for $t = 5.444, 4.205$)

*² Less than 210mg in 95% of administrations.

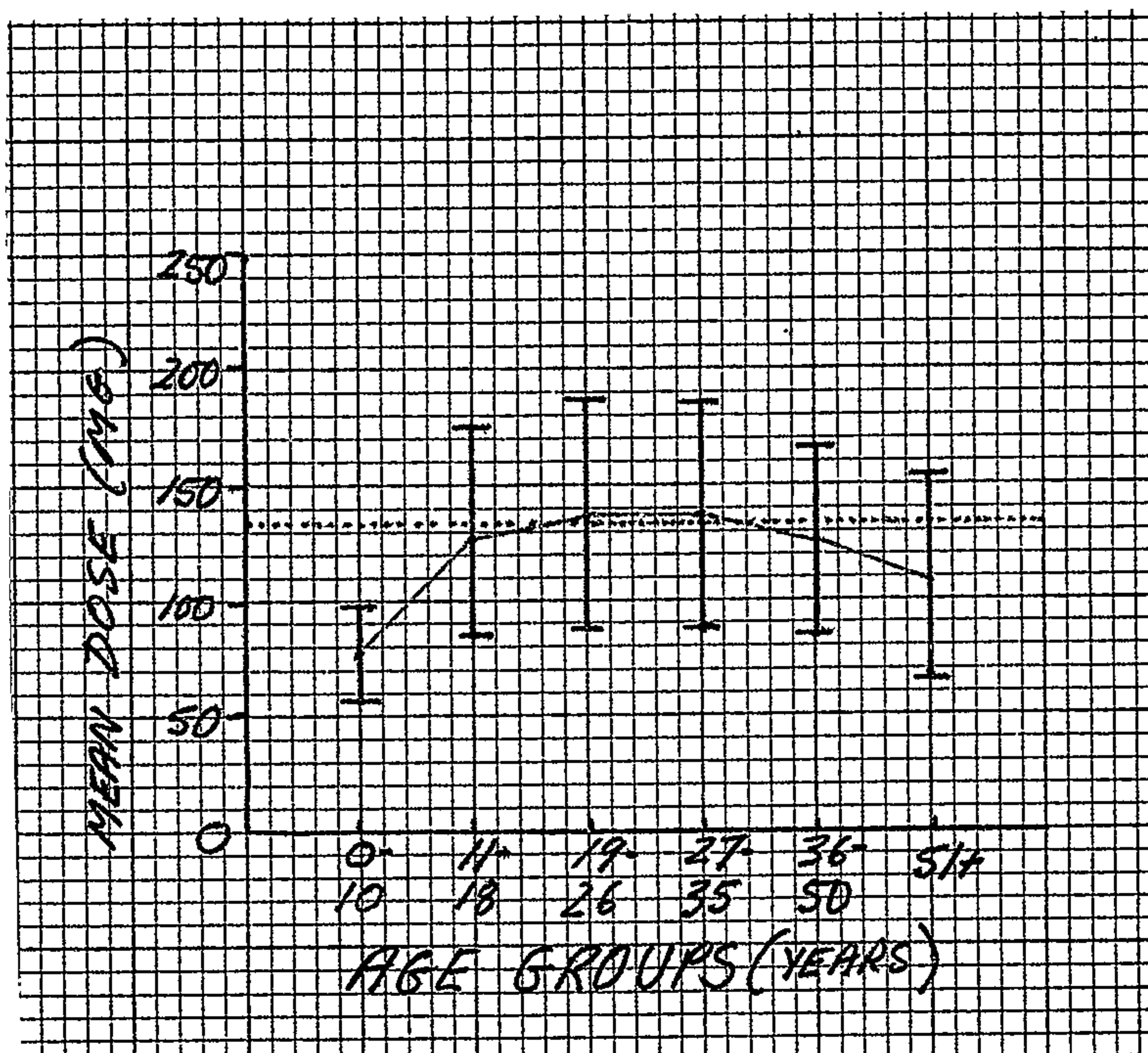
TABLE 210-9			
51+ YEAR AGE GROUP			
MEAN TOTAL DOSAGE (MG)			
ADMINISTRATIONS WITHOUT DIAZEPAM OR L.A.			
	MALES	FEMALES	TOTAL
Lowest	60	40	40
Highest* ²	200	360	360
Mean	112	105	108* ¹
S.D.	45.51	44.87	43.51
Number of Administrations	52	106	158

*¹ Higher than 0-10 year group. Difference highly significant ($0.001 > p$, $t = 5.386$)

*¹ Lower than 11-18 year, 19-26 year, 27-35 year and 36-50 year groups. All differences are highly significant ($0.001 > p$, respective values for $t = 3.889, 7.960, 7.028, 3.601$)

*² Less than 190mg in 95% of administrations

DIAGRAM 210-1
 MEAN DOSAGE OF AGE GROUPS FOR ADMINISTRATIONS
 WITHOUT DIAZEPAM OR L.A.



1. For each age group the mean total dose of methohexitone is shown $\pm$ I.S.D.
2. Overall mean (132mg)-----

2-10-2a: Discussion

1. The mean total dosage for unsupplemented administrations was less than that for the whole study (compare Tables 210-2 and 210-1).

This is expected because supplements were not used if the treatment was simple and good working conditions were anticipated.

2. The 0-10 year age group had the lowest mean total dose. This result confirms the findings of others (see Section 1-5-4d(ii)).
3. The 11-18 year age group had a higher mean total dose. This result confirms the findings of Recant (1960) (see Section 1-5-4d(ii)). Despite treatment preselection (see Section 2-7-1a(3)), the group had a high incidence of operating complications which may have increased mean total dosage (see Section 2-11-2a(3)).
4. The 51+ year age group received a low mean total dose. This result is similar to the findings of others (see Section 1-5-4d(iii)).

2-10-1b: Conclusion

Dosage requirements are less at the extremes of age. This finding is most likely due to the nature of the treatment given to patients in these age groups.

2-10-3: ADMINISTRATIONS SUPPLEMENTED BY DIAZEPAM ONLY

The statistics are presented in Table 210-10.

TABLE 210-10 MEAN TOTAL DOSAGE (MG) ADMINISTRATIONS SUPPLEMENTED BY DIAZEPAM			
	MALES	FEMALES	TOTAL
Lowest	40	20	20
Highest* ³	500	560	560
Mean	190* ¹	170* ¹	178* ²
S.D.	80.39	71.74	74.79
Number of Administrations	535	875	1410

*¹ Difference is highly significant
($t = 4.719$, $0.001 > p$)

*² Higher than that for unsupplemented administrations
($t = 20.783$, $0.001 > p$)

*³ Less than 330mg in 95% of administrations

*³ Above 200mg in 39% of administrations

2-10-3a: Discussion

These results do not disprove the theory (Section 1-11-6h) that diazepam supplementation reduces the total dose of methohexitone: Because, in cases where diazepam supplementation was used, the treatment was more difficult. I have no idea what the total dose of methohexitone might have been had diazepam not been used.

2-10-3b: Conclusion

Administrations of methohexitone supplemented with diazepam were associated with high doses of methohexitone often exceeding recommended limits.

2-10-4: ADMINISTRATIONS SUPPLEMENTED BY LOCAL ANALGESIA ONLY

The statistics are presented in Table 210-11.

TABLE 210-11 MEAN TOTAL DOSAGE (MG) ADMINISTRATIONS SUPPLEMENTED BY LOCAL ANALGESIA			
	MALES	FEMALES	TOTAL
Lowest	80	40	40
Highest* ³	500	400	500
Mean	158* ²	182	168* ¹
S.D.	74.75	67.37	73.08
Number of Administrations	53	39	92

*¹ Higher than that for unsupplemented administrations.
Difference highly significant ($t = 4.688$, $0.001 > p$)

*² Lower than that for administrations supplemented by diazepam. Difference significant ($t = 2.952$, $0.01 > p > 0.001$)

*³ Above 200mg in 33% of administrations

2-10-4a: Discussion

1. It is interesting, although not significant, that females had a higher mean total dose than males. This is true for each age group.

The numbers are too low for significance, therefore it would be worthwhile to follow this anomaly further in a larger study.

2. These results reflect the type of treatment carried out when local analgesia is used to supplement methohexitone (see Section 2-9-3) and do not disprove theories that local analgesia helps reduce total dose of methohexitone. I have no idea what the total dose of methohexitone might have been had local analgesia not been used.

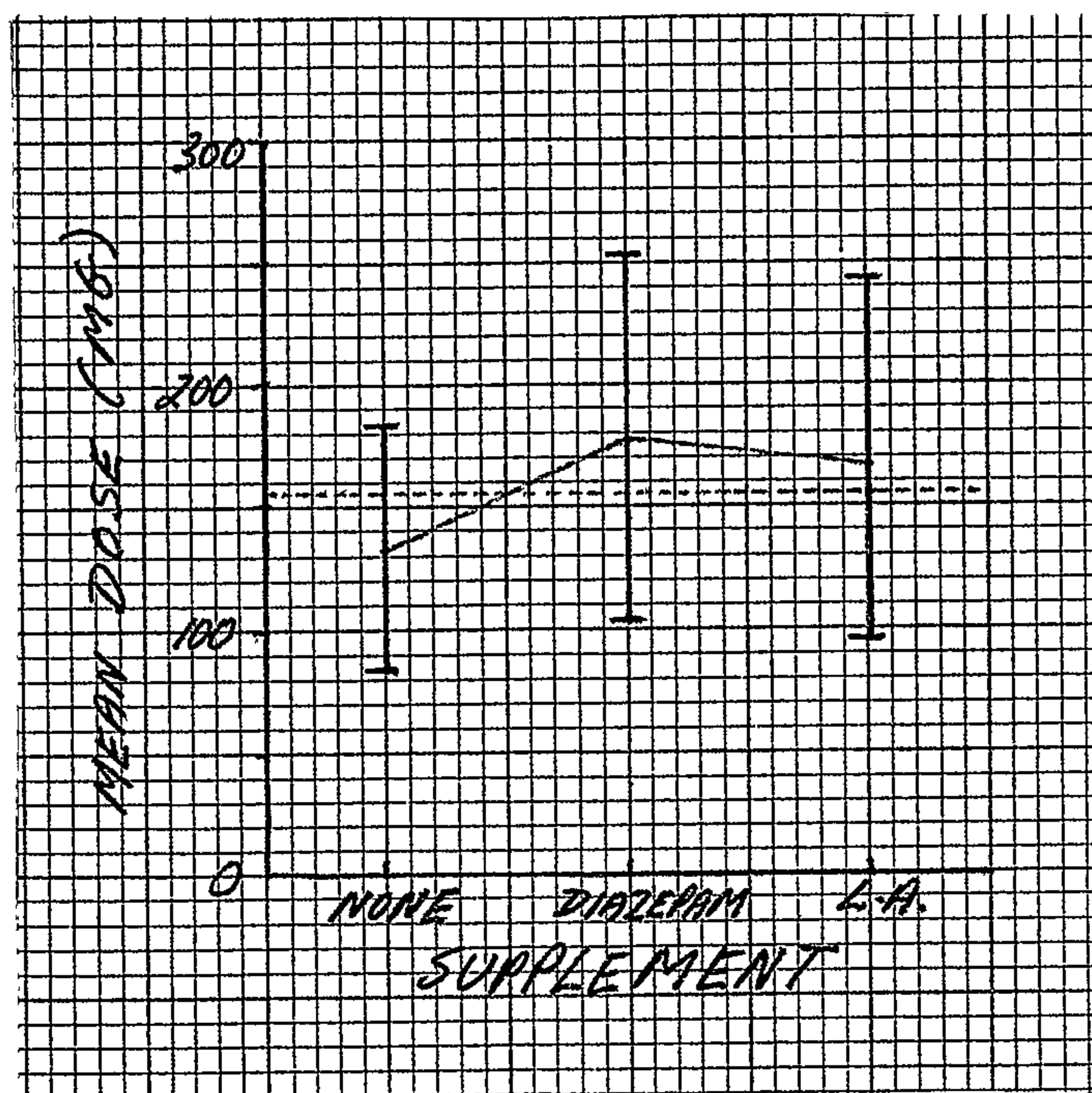
2-10-4b: Conclusion

Administrations of methohexitone supplemented by local analgesia were associated with high doses of methohexitone often exceeding recommended limits.

2-10-5: DISCUSSION OF DOSAGE OF METHOHEXITONE WITH AND WITHOUT SUPPLEMENTS

The statistics are shown in Diagram 210-2.

DIAGRAM 210-2
 MEAN TOTAL DOSE WITH SUPPLEMENTS



1. For each group the mean total dose is shown $\pm$ I.S.D.
2. Mean for whole study 151mg $\dashv$ - - - - -

1. With unsupplemented administrations, the maximum recommended dosage was rarely exceeded.
2. Significantly higher dosages were associated with diazepam or local analgesia supplementation. Often the recommended maximum dosage limits were exceeded.

2-10-6: ADMINISTRATIONS FOR CONSERVATION

The statistics for unsupplemented administrations are shown in Table 210-12, for diazepam supplemented in Table 210-13, and for local analgesia supplemented in Table 210-14; and for all, in diagram 210-3.

TABLE 210-12 MEAN TOTAL DOSAGE (MG) CONSERVATION - UNSUPPLEMENTED			
	MALES	FEMALES	TOTAL
Lowest	60	40	40
Highest* ³	340	340	340
Mean	141* ¹	133* ¹	136* ²
S.D.	48.84	47.29	48.28
Number of Administrations	626	998	1624

*¹ Difference significant ($t = 3.252$, $0.01 > p > 0.001$)

*² Lower than that for administrations supplemented by diazepam. Difference highly significant ($t = 16.315$, $0.001 > p$)

*³ Less than 230mg in 95% of administrations

TABLE 210-13 MEAN TOTAL DOSE (MG) CONSERVATION - DIAZEPAM SUPPLEMENT			
	MALES	FEMALES	TOTAL
Lowest	40	20	20
Highest* ³	500	450	500
Mean	191* ¹	168* ¹	177* ²
S.D.	78.46	67.23	72.16
Number of Administrations	409	658	1067

*¹ Difference highly significant ($t = 4.682$, $0.001 > p$)

*² Higher than unsupplemented. Difference highly significant ($t = 16.315$, $0.001 > p$)

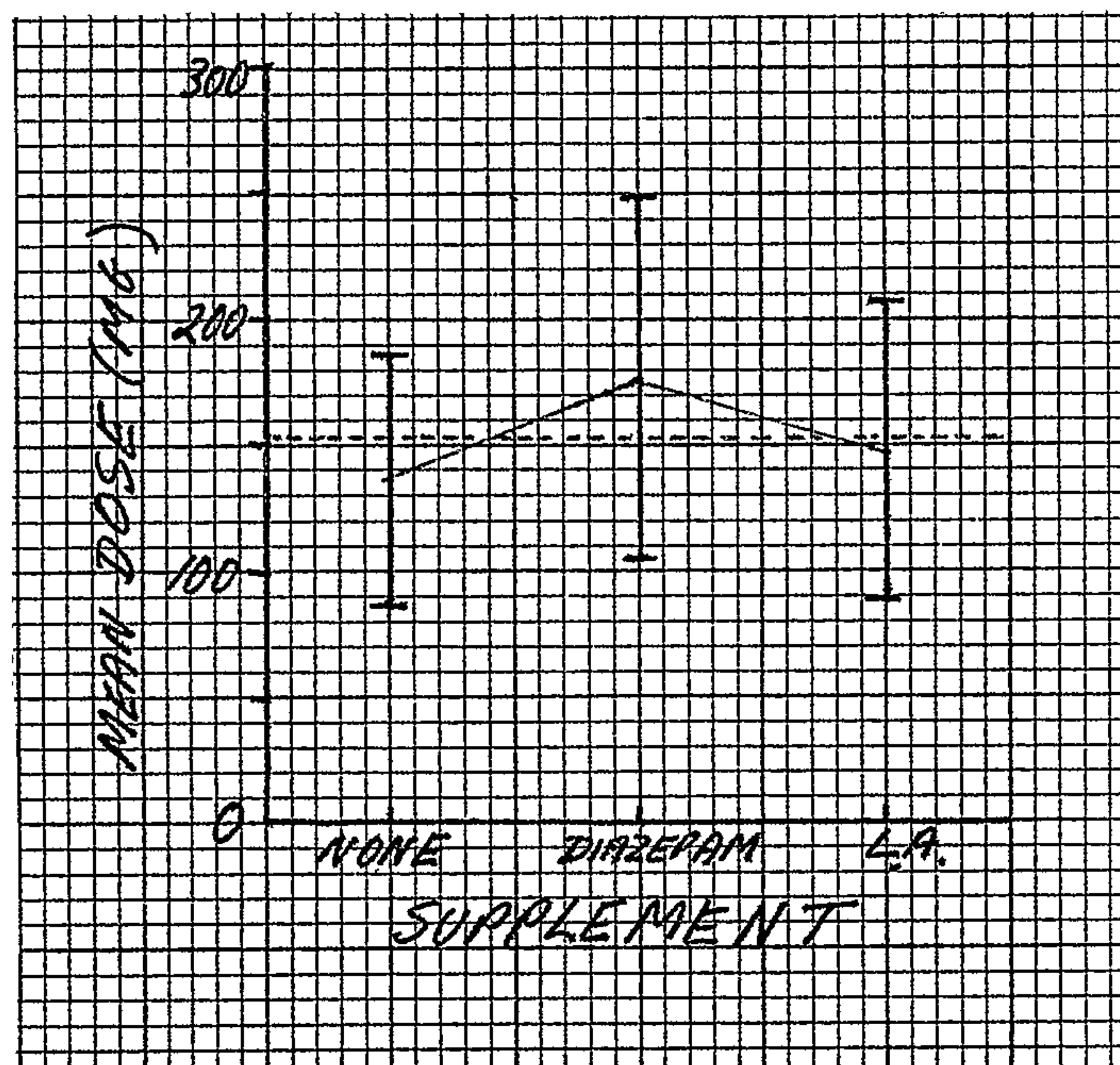
*² Higher than that for local analgesia supplemented. Difference is significant ($t = 8.845$, $0.01 > p > 0.001$)

*³ More than 200mg in 37% of administrations

TABLE 210-14 MEAN TOTAL DOSAGE (MG) CONSERVATION - L.A. SUPPLEMENT			
	MALES	FEMALES	TOTAL
Lowest	80	40	40
Highest	240	260	260
Mean	136	164	148* ¹
S.D.	44.86	67.71	58.09
Number of Administrations	26	20	46

*¹ Lower than that for administrations supplemented by diazepam. The difference is significant ($t = 3.279, 0.01 > p > 0.001$)

DIAGRAM 210-3
 MEAN TOTAL DOSE
 CONSERVATION



1. For each group the mean total dose is shown $\pm$ I.S.D.
2. Mean for whole study (151mg) — — — — —

2-10-6a: Discussion

1. The mean total dosages are higher than that reported by Beesley et al (1969) (see Section 1-5-10c).
2. Diazepam supplementation is associated with high mean total dosages often exceeding the recommended maximum dose.
3. Local analgesia supplementation was not associated with higher mean dosages compares to administrations with no supplementation.

2-10-6b: Conclusion

Local analgesia may have helped to keep dosage of methohexitone within the recommended limit for conservation.

2-10-7: ADMINISTRATIONS FOR ORAL SURGERY

The statistics for unsupplemented administrations are shown in Table 210-15, for diazepam supplemented in Table 210-16, for local analgesia supplemented in Table 210-17, and for all, in Diagram 210-4.

TABLE 210-15 MEAN TOTAL DOSAGE (MG) SURGERY - UNSUPPLEMENTED			
	MALES	FEMALES	TOTAL
Lowest	60	60	60
Highest* ³	400	380	400
Mean	123* ¹	108* ¹	115* ²
S.D.	52.66	37.60	45.73
Number of Administrations	250	289	539

*¹ Difference is significant ($t = 3.752$, $0.001 > p$)

*² Lower than that for L.A. supplemented. Difference is highly significant ($t = 5.887$, $0.001 > p$)

*² Lower than that for diazepam supplemented. Difference is highly significant ($t = 3.588$, $0.001 > p$)

*³ Less than 210mg in 95% of administrations

TABLE 210-16 MEAN TOTAL DOSAGE (MG) SURGERY - DIAZEPAM SUPPLEMENT.			
	MALES	FEMALES	TOTAL
Lowest	80	40	40
Highest* ²	300	300	300
Mean	161	151	156* ¹
S.D.	90.33	92.08	90.75
Number of Administrations	30	35	65

*¹ Higher than that for unsupplemented. Difference highly significant ($t = 3.588$, $0.001 > p$)

*¹ Lower than that for local analgesia supplemented. Difference may be significant ($t = 2.224$, $0.05 > p > 0.02$)

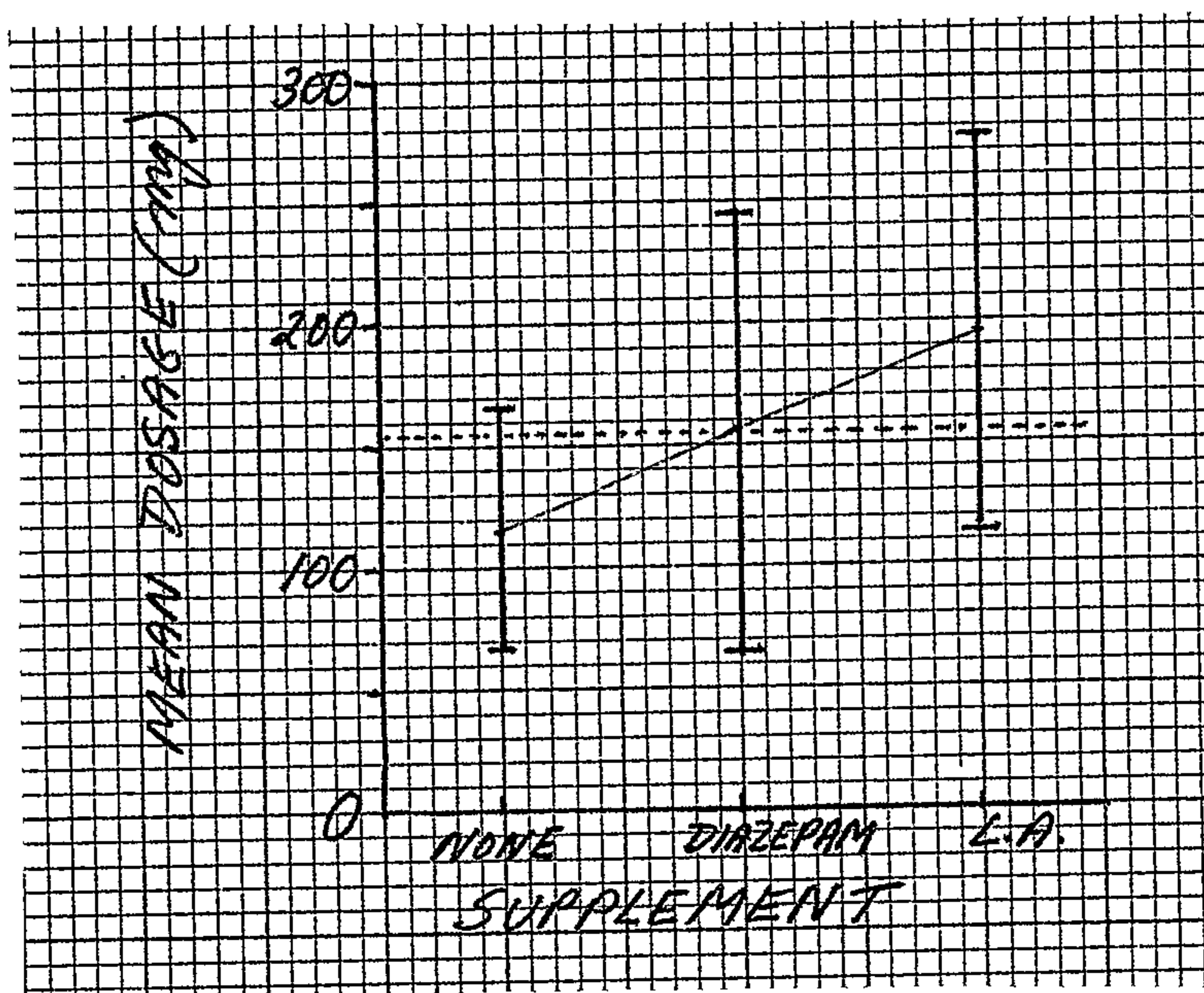
*² Above 200mg in 31% of administrations

TABLE 210-17			
MEAN TOTAL DOSAGE (MG)			
SURGERY - LOCAL ANALGESIA SUPPLEMENT			
	MALES	FEMALES	TOTAL
Lowest	80	80	80
Highest	500	400	500
Mean	191	199	195* ¹
S.D.	94.72	65.82	81.79
Number of Administrations	19	18	37

*¹ Higher than that for unsupplemented administrations.
Difference highly significant ($t = 5.887$, $0.001 > p$)

*¹ Higher than that for diazepam supplemented.
Difference may be significant ($t = 2.224$, $0.05 > p > 0.02$)

DIAGRAM 210-4
 MEAN TOTAL DOSE
 SURGERY



1. For each group the mean total dose is shown $\pm$ I.S.D.
2. Mean for whole study (151mg)

2-10-7a: Discussion

1. Comparison with the results of others (see Table 5-9, Section 1-5-10a) is difficult because in some studies the treatment is simple extractions and in others it is impacted third molars.
2. Significantly high dosages of methohexitone were associated with local analgesia supplementation for surgery. This is a reflection on the method of treatment: If a planned simple extraction became difficult (i.e. root fracture), local analgesia was then administered so that the procedure could continue without increasing the dosage of methohexitone.
3. If a difficult extraction was expected, diazepam was given prior to induction with methohexitone. Whilst dosage was reduced compared to administrations supplemented by local analgesia, the maximum recommended limit was exceeded in about 31% of administrations.

2-10-7b: Conclusion

1. Local analgesia was used to retrieve difficult situations and probably did help to reduce mean total dosage.
2. Diazepam was used to prevent the need for high dosages of methohexitone. However, its use was still associated with high dosages.

2-10-8: ADMINISTRATIONS FOR ENDODONTICS

The statistics for unsupplemented administrations are shown in Table 210-18, for diazepam supplementation in Table 210-19, for local analgesia supplementation in Table 210-10, and for all, in Diagram 210-5.

TABLE 210-18 MEAN TOTAL DOSE (MG) ENDODONTICS - UNSUPPLEMENTED			
	MALES	FEMALES	TOTAL
Lowest	80	60	60
Highest* ¹	360	320	360
Mean	138	128	132
S.D.	51.11	42.51	43.76
Number of Administrations	107	216	323

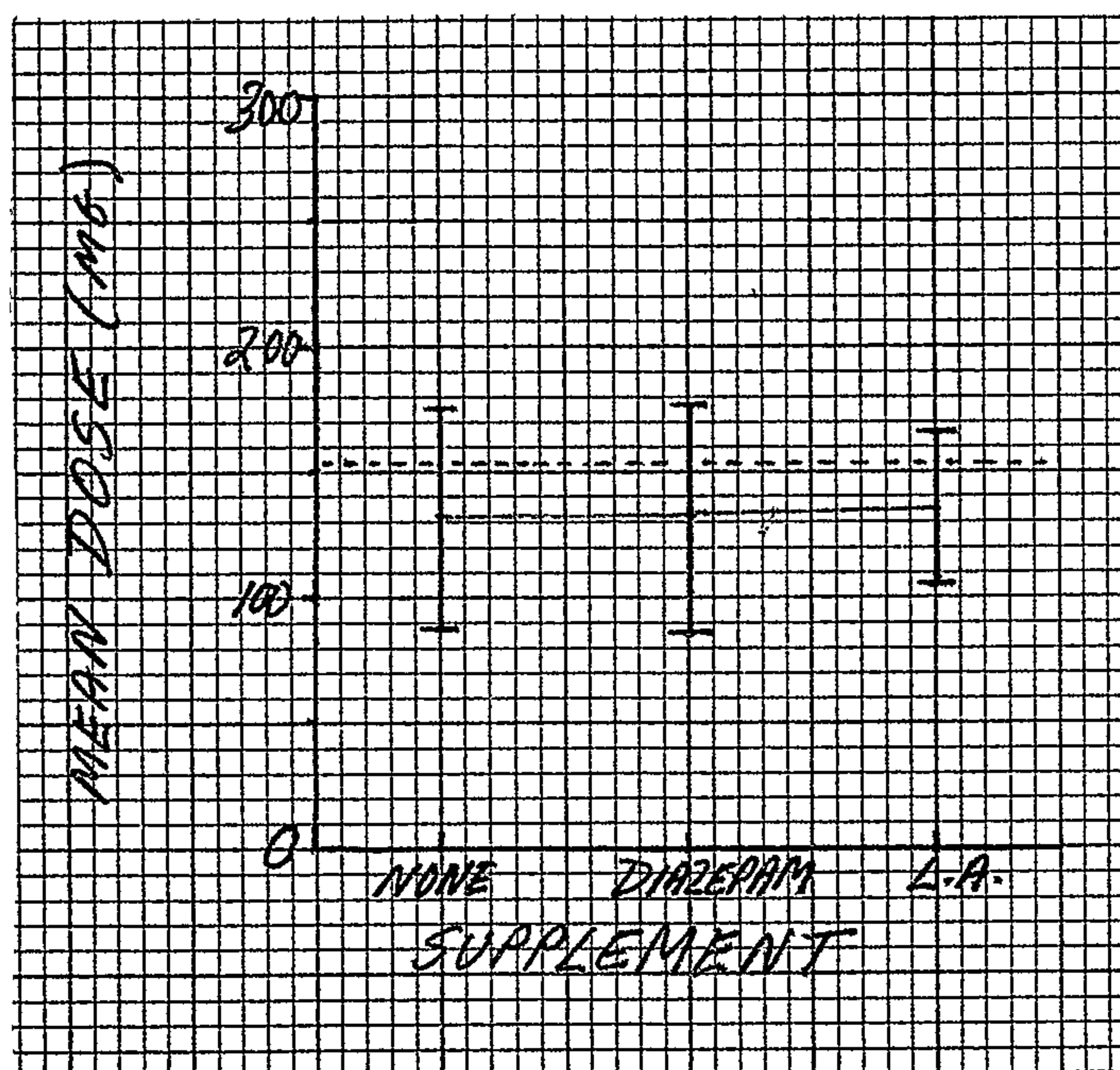
*¹ Less than 220mg in 95% of administrations

TABLE 210-19 MEAN TOTAL DOSE (MG) ENDODONTICS - DIAZEPAM SUPPLEMENT			
	MALES	FEMALES	TOTAL
Lowest	60	60	60
Highest* ¹	280	280	280
Mean	129	134	132
S.D.	49.29	42.66	46.22
Number of Administrations	37	84	121

*¹ Less than 220mg in 95% of administrations

TABLE 210-20 MEAN TOTAL DOSE (MG) ENDODONTICS - L.A. SUPPLEMENT			
	MALES	FEMALES	TOTAL
Lowest	100	-	100
Highest	200	-	200
Mean	134	-	134
S.D.	30.95	-	30.95
Total number of Administrations	7	-	7

DIAGRAM 210-5
 MEAN TOTAL DOSE - ENDODONTICS



1. For each group the mean total dose is shown $\pm$ I.S.D.
2. Mean for whole study (151mg)-----

2-10-8a: Discussion

1. It was generally possible to keep within the recommended dosage limits.
2. There was less variation than for other forms of treatment.

2-10-8b: Conclusion

Half of endodontic treatment is for very painful procedures (see Section 2-7-3) and yet dosage limits were rarely exceeded.

2-10-9: COMPARISON OF MEAN TOTAL DOSE BETWEEN ADMINISTRATIONS
FOR CONSERVATION AND ADMINISTRATIONS FOR SURGERY

To eliminate some of the many variables which may affect mean total dose, I have used the criteria listed below as a basis for comparison:

1. In this context, *conservation* means one simple filling.
2. Similarly, *surgery* means one simple extraction.
3. Only administrations without supplementation were analysed.
4. Only administrations to the 19-26 year and 27-35 year age groups were included.
5. Only administrations to patients in good health and of average build were included.
6. Administrations to very nervous or aggressive patients were excluded.

The statistics are presented in Tables 210-21 and 210-22, and Diagram 210-6.

TABLE 210-21 MEAN TOTAL DOSE (MG) ONE FILLING ONLY 19-26 YEAR & 27-35 YEAR GROUPS			
	MALES	FEMALES	TOTAL
Lowest	80	60	60
Highest* ³	260	260	260
Mean	127* ¹	119* ¹	122* ²
S.D.	34.25	34.25	34.23
Number of Administrations	248	428	676

*¹ Difference is significant ($t = 2.927$, $0.01 > p > 0.001$)

*² Higher than that for one simple extraction.
Difference is highly significant ($t = 7.791$, $0.001 > p$)

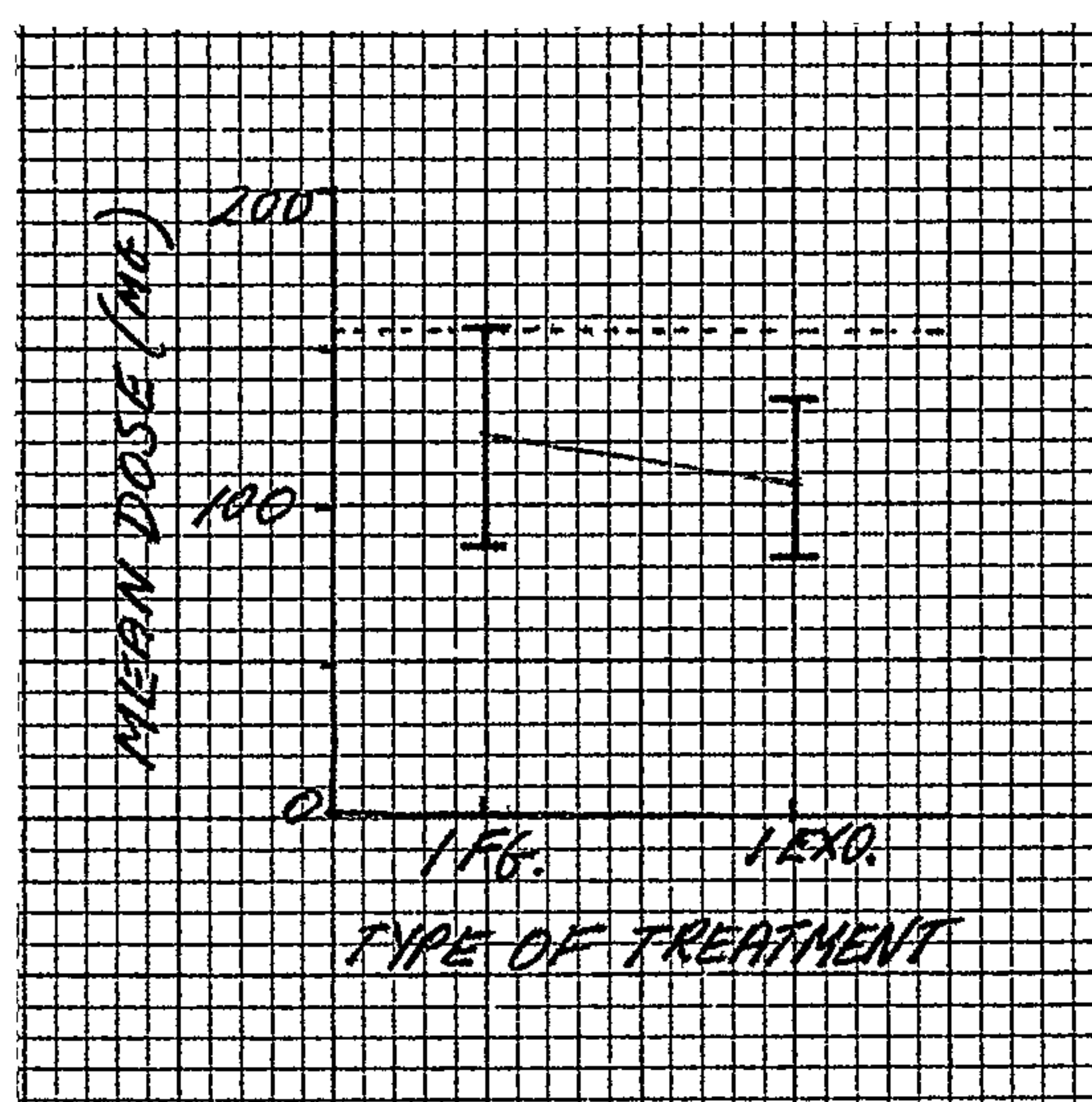
*³ Less than 190mg in 95% of administrations

TABLE 210-22 MEAN TOTAL DOSE (MG) ONE EXTRACTION ONLY 19-26 YEAR & 27-35 YEAR AGE GROUPS			
	MALES	FEMALES	TOTAL
Lowest	80	80	80
Highest	200	200	200
Mean	112* ¹	101* ¹	106* ²
S.D.	27.68	25.14	24.82
Total number of Administrations	102	146	248

*¹ Difference is significant
($t = 3.197$, $0.01 > p > 0.001$)

*² Lower than that for one filling. Difference is highly significant ($t = 7.791$, $0.001 > p$)

DIAGRAM 210-6
 MEAN TOTAL DOSE
 COMPARISON BETWEEN ONE FILLING & ONE EXTRACTION



1. For both groups the mean total dose is shown $\pm$ I.S.D.
2. Mean dose for whole study (151mg) — — — — —

2-10-9a: Discussion

1. For a meaningful comparison, the variables of duration, difficult or painful procedures, extremes of age, health status, weight and temperament were eliminated as far as possible.
2. In such cases, low mean total doses of methohexitone are possible.
3. Males required higher mean total doses than females.
4. Less dosage is required for an extraction than a filling.

2-10-9b: Conclusion

The mean total dosage for one simple filling or one simple extraction was well within recommended limits.

2-10-10: GENERAL CONCLUSIONS

1. Males required higher mean total doses than did females.
2. The lowest mean total doses were for administrations to the 0-10 year and 51+ year age groups.
3. Diazepam supplementation, designed to reduce mean total dose, was associated with high mean total doses.
4. Local analgesia supplementation, usually given to retrieve good working conditions, was associated with high mean total doses.
5. Conservation required higher mean total doses than did surgery or endodontics.
6. It is possible to keep dosage below the recommended maximum for endodontic treatment.

7. By eliminating many variables, and restricting treatment to one simple filling or extraction, it is possible to keep dosage below the recommended maximum.