



Australian Osteopath's Attitudes towards Anatomy Training as Part of their Pre-Professional Education

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Abstract

Since the inception of osteopathy as a health profession in the late 19th century, anatomy has played a fundamental role in practitioners' education. The aim of this study was to explore attitudes towards anatomy of Australian osteopathic practitioners (osteopaths) by way of a questionnaire-based survey. This survey was distributed to osteopathic practitioners at a national osteopathic conference and an osteopathic workshop in 2015. From 175 attendees, 168 surveys were returned (96.0% response rate), which represents 8.73% (168/1925) of Australian registered osteopaths in 2015. Among the respondents, 48.2% were male and 51.8% female, with an age distribution similar to that of the registered practitioners. Respondents had a mean of 11.1 years in clinical practice and 87.5% of them had studied osteopathy in Australia. Respondents considered that the anatomy curriculum in their pre-professional osteopathic programmes contained enough detail for safe clinical practice. A large majority (88.6%) of respondents agreed that the anatomy content should be integrated with clinical subjects and spread throughout the osteopathic programme. Respondents were provided with access to a wide range of anatomy learning resources in their anatomy training and 84.9% preferred the learning of anatomy content from cadavers. A clear majority of respondents favourably consider the anatomy curriculum within their pre-professional osteopathic programmes and the relevance of anatomy for safe clinical practice. They highlighted the importance of clinically integrated delivery and use of cadavers in anatomy teaching. These results will inform future osteopathic educators to ensure anatomy curriculum in pre-professional osteopathic programmes is relevant and adequate.

Keywords: Osteopathy education; Anatomy education; Anatomy; Curriculum

Introduction

Osteopathy is a health profession based on the relationship between the structure of the body and how it

functions, using palpation and manual techniques primarily on the musculoskeletal system to affect health [1-3]. In the USA, osteopathic physicians are considered equivalent to medical practitioners with full practice rights involving

prescriptions and surgery (osteopathic medicine) [4,5]. In other countries, including Australia and New Zealand, osteopathic practitioners (osteopaths) primarily employ manual therapy to the musculoskeletal system in order to improve health [4,5]. For both osteopathy and osteopathic medicine, a thorough knowledge of anatomy is not only fundamental to the practice of osteopathy for the formulation of appropriate diagnoses, interpretation of medical images, but is also required in the appropriate implementation, and integration of osteopathic principles in the pursuit of optimal function and health [6-9]. Historically, anatomy has also been important in the training of osteopaths [6]. The founder of osteopathy Andrew Taylor Still (1828-1917), emphasised to his students the need for a thorough knowledge and understanding of anatomy in clinical practice, when he stated:

“We teach you anatomy in all its branches, that you may be able to have and keep a living picture before your mind all the time, so that you can see all joints, ligaments, muscles, glands, arteries, veins, lymphatics, fascia superficial and deep, all organs” [6].

Accordingly, anatomy has continued to feature prominently within osteopathic curricula due to an adherence to underlying osteopathic principles [10-14].

As the primary objective of health profession curricula is to produce competent practitioners, it is necessary to consider the perceptions of practitioners when reviewing curricula [15-18]. Several studies have surveyed health practitioners' perceptions of anatomy including medical practitioners [19-21], occupational therapists [16,22], physiotherapists [23], chiropractors [24], and osteopaths [25]. However, osteopaths' attitudes towards the relevance and adequacy of their anatomy training, as well as different ways of anatomy teaching as part of pre-professional osteopathic education, has not been investigated. A knowledge and understanding of osteopaths' opinion of the relevance and adequacy of anatomy training in preparation for clinical practice, should be considered as essential for informing designers of future osteopathic curricula.

The aim of this study was to investigate the attitudes of Australian osteopathic practitioners towards the anatomy training, and mode of delivery as part of their pre-professional education.

Materials and Methods

This study used a questionnaire-based survey designed to explore the attitudes of practitioners towards anatomy teaching, how it was taught, how it should be taught, and its clinical relevance. Data collection was carried out via

a questionnaire that had been previously used in similar studies on medical students, clinicians, and educators [26,27]. Relevant questions from the original questionnaires were collated, reviewed and refined by the research team in the current study. The questionnaire was also shared with two experienced osteopathic educators for comment, and their feedback was incorporated into the final version of the questionnaire.

The questionnaire tool collected data across two domains: (a) demographics and educational background of participants (i.e. age, gender, university of graduation, year of graduation); and (b) responses to statements on the role of anatomy in participant's osteopathic pre-professional curriculum, its relationship with clinical practice, and different modes of anatomy teaching. These statements employed a 5-point Likert scale response format, where participants were requested to express their degree of agreement from strongly disagree to strongly agree [25,28].

Printed copies of the questionnaire were distributed to participants at the 2015 Osteopathy Australia National Conference and at a postgraduate osteopathic workshop held in the same year. Practitioners who attended both the conference and workshop only completed the questionnaire on one occasion. The annual Osteopathy Australia conference was convened by the national peak body representing the osteopathic profession in Australia. The postgraduate osteopathic workshop was an informal gathering of osteopathic practitioners. While a small number of students participated in this workshop, only responses collected from practitioners (those who had already obtained their osteopathic qualification) were included in this study. All data was de-identified and confidential. This study was approved by the Southern Cross University Human Research Ethics Committee (ECN-14-242).

Descriptive statistics were used to compare participants' age and gender distribution to the pool of registered osteopathic practitioners at the time of data collection i.e. 2015 [29,30]. All data were expressed as percentages or mean values (\pm standard error of the mean, SEM). Associations between parameters with categorical variables were investigated using ordinal logistic regression. Statistical analyses were done using IBM SPSS (v. 25; IBM SPSS, Armonk, NY).

Results

A total of 168 respondents completed the questionnaire. This represents a response rate of 96.0% of the attendees. The total number of respondents represented 8.73% (168/1925) of the total number of registered osteopathic practitioners in Australia at the time [29,30]. Table 1 outlines

the demographic details of participants and compares them to 2015 osteopathic registrants. There was no significant difference in proportion of males and females in the survey participants to that for practicing osteopaths (Chi-Square

Goodness of Fit Test, p-value=0.145). The age distribution of the survey participants was not significantly different from the age distribution of practicing osteopaths (Chi-Square Goodness of Fit Test, p-value=0.132).

Demographic Details of Participants					Osteo Board Registrants ^a	
Gender	n	%	Age Mean	Age SEM	n	%
Female	81	51.8	36.6	1.16	1030	53.82%
Male	87	48.2	41.8	1.31	985	46.18%
All participants	168	100	39.3	0.9	1925	100.00%

^aOsteopathy Board, 2015, SEM = Standard of the error mean

Table 1: Demographic Details of Participants.

Details of the years of clinical practice of the participants, according to university of graduation, are shown in Table 2. As some educational institutions were small private colleges in the 1980s and no longer exist, graduates from this group had, on average, more years of clinical practice compared to graduates from current osteopathic programmes. Individual universities were anonymised and included both current and

past programmes (in no particular order): Victoria University (current), Southern Cross University (current), Royal Melbourne Institute of Technology University (current), University of Western Sydney (not current), overseas trained (non-Australian), and small, private, independent colleges (not current) in Sydney, New South Wales.

Uni	n	Mean	SEM	Minimum	Maximum
1	48	7	0.7	0	15
2	34	0.7	0.2	0	3
3	28	13.5	1.2	3	24
4	21	8	0.5	4	12
5	19	20.7	2.5	1	39
6	18	31.1	1.2	25	43
Total	168	11.1	0.8	0	43

SEM= Standard of the Error Mean

Table 2: Years of Clinical Practice of Participants (in years).

Table 3 outlines the mean (\pm SEM) agreement ratings (on a 1-5 Likert scale, where 1= 'Strongly Disagree' and 5= 'Strongly Agree') for statements addressing the role of anatomy in a participant's osteopathic pre-professional curriculum and its relationship with clinical practice.

All fourteen statements on the questionnaire were clustered into three themes: anatomy knowledge and competent practitioners (statements 1-5); anatomy content organisation (statements 6-9); and anatomy teaching resources (statements 10-14). Under the first theme, all participants rated either agree (5.8%) or strongly agree (94.2%) to statement 1. Participants agreed with the statement concerning the relationship between anatomy knowledge and safe, competent practitioners. There were

no significant differences in responses to these statements based on demographic parameters. Participants responded favourably when asked to rate statements concerning the adequacy of time dedicated to teaching anatomy within their osteopathic programme, and the applicability of anatomy to clinical practice. Under the second theme relating to the organisation of anatomy content, participants considered that anatomy should ideally be taught within a clinical context, across the entire programme, and demonstrated a preference for an integrated programme pedagogy, where the different biomedical sciences are taught together in a systems-based sequence. Under the third theme of the availability of anatomy teaching resources, participants preferred the use of cadavers in their learning of anatomy.

	Statements	Participant Responses (%)					n	Mean	SEM
		SD	D	N	A	SA			
Theme 1: Anatomy knowledge and safe, competent practitioners:									
1	Knowledge of anatomy is important for safe and competent practice.	0	0	0	6	94	168	4.94	0.018
2	Anatomy learnt in your osteopathic course can easily be applied in routine clinical practice.	0	2.4	3.6	26.3	67.7	167	4.59	0.052
3	Anatomy was taught in sufficient detail in my osteopathic course to prepare me for my current level of practice.	0	3.6	6	45.2	45.2	166	4.32	0.058
4	My osteopathic course dedicated adequate time for teaching anatomy.	0	6	9.6	41.3	43.1	167	4.22	0.066
5	The structure of anatomy curriculum in my osteopathic course/study is adequate for safe clinical practice.	0	3	4.2	49.4	43.5	168	4.33	0.054
Theme 2: Anatomy content organisation:									
6	Anatomy teaching should be spread over all years within an osteopathic course.	0	2.4	9	28.1	60.5	167	4.47	0.059
7	Anatomy is best taught in pre-clinical years.	5.5	10.1	31.5	29.1	23.6	165	3.55	0.087
8	Anatomy is best taught in a clinical context.	0.6	1.8	18.1	39.2	40.4	166	4.17	0.064
9	Anatomy should not be taught as a separate subject, but should be merged into other relevant topics (e.g. Cardiovascular system, GIT).	7.9	17	27.9	27.9	19.4	165	3.34	0.093
Theme 3: Anatomy teaching resources:									
10	With alternatives, use of cadavers is unnecessary.	50	34.9	9.6	3.6	1.8	166	1.72	0.071
11	Dissection is better than prosection.	0	0.6	1.2	0.6	97.6	168	4.95	0.025
12	Interactive learning is more beneficial for anatomy than reading textbooks.	1.2	2.4	14.5	33.1	48.8	166	4.26	0.068
13	Synthetic plastic models are useful for learning anatomy.	1.8	3	10.2	56.9	28.1	167	4.07	0.063
14	Anatomy computer simulated models are useful in learning anatomy.	0	1.8	18.6	52.2	27.5	167	4.05	0.057

SD= Strongly Disagree (1), D= Disagree (2), N= Neutral (3), A= Agree (4), SA= Strongly Agree (5), n= number, SEM= Standard of the error mean.

Table 3: Mean (\pm SEM) agreement ratings (on a scale 1- 5 Likert scale, where 1= 'Strongly Disagree' and 5 = 'Strongly Agree') for statements related to linkage between anatomy education and clinical practice.

Participants were asked to state what type of anatomical teaching resources they had access to while studying the anatomy component of their osteopathic pre-professional

training. Table 4 outlines the anatomy learning resources available to participants as part of their pre-professional education (expressed as a percentage of participants).

Teaching resources/tools	%
Lectures	97.6
Plastic models	96.4
Atlases	90.5
Diagnostic imaging (X-rays, MRI)	88.1
Prosection of cadavers	78.6
Platinated specimens	67.9
Dissection of cadavers	55.1*
Examination of 'potted' specimens	54.2
3D Anatomy Computer Simulation Models	32.7
Body Painting	19

*One missing value.

Table 4: Available anatomical teaching tools.

Participant responses to statements numbered 3, 4, 5, 6 and 10 showed association between variables (university of graduation, or years of practice, and gender). All other statements (*i.e.* statements 1, 2, 7, 8, 9, 11, 12, 13 and 14),

University		D	N	A	SA	Total
1	Count	0	2	12	34	48
	% w in Uni	0.00%	4.20%	25.00%	70.80%	100%
2	Count	0	2	13	12	27
	% w in Uni	0.00%	7.40%	48.10%	44.40%	100%
3	Count	6	4	29	4	34
	% w in Uni	17.60%	11.80%	58.80%	11.80%	100%
4	Count	0	3	6	10	19
	% w in Uni	0.00%	15.80%	31.60%	52.60%	100%
5	Count	2	4	10	2	18
	% w in Uni	11.10%	22.20%	55.60%	11.10%	100%
6	Count	2	1	8	10	21
	% w in Uni	9.50%	4.80%	38.10%	47.60%	100%
Total	Count	10	16	69	72	167
	% w in Uni	6.00%	9.60%	41.30%	43.10%	100%

Table 6: Distribution of responses by Uni of graduation for statement 4.

Discussion

This study investigated the attitudes of osteopathic practitioners towards their anatomy training, as a component of their pre-professional education. Participants considered their anatomy training as satisfactory, and adequate preparation for osteopathic clinical practice. These findings align with existing investigations among Australian chiropractors [24], Scottish medical practitioners

showed no association with any of the variables. Table 5 describes the association between variables which influenced participant responses (ordinal logistic regression).

Statement number	Variable	P values
3	Uni of graduation	<0.001
4	Uni of graduation	<0.0005
5	Uni of graduation	0.002
6	Uni of graduation	0.001
10	Gender	0.019

Using ordinal logistic regression.

Table 5: Association between variables for some statements

Table 6 shows the different responses to statement 4 (*i.e.* "My osteopathic course dedicated adequate time for teaching anatomy.") according to the university or institution of graduation. There were significant differences between participants who had graduated from university 1, 3, and 5 compared to university 6 ($p < 0.0005$).

[19], English medical practitioners [31], Spanish medical graduates [21] and international medical reviews [32,33].

The issue of the adequacy of anatomy training within medical education for safe medical practice, has been the topic of much debate, with calls for required minimum levels of anatomy knowledge for safe and competent medical practice to be established [34-36]. Similar claims have been made within chiropractic education [37]. Although there has

been a steady decline in the number of teaching hours devoted to the anatomical sciences in medical and health profession education over recent years [20,38-42], respondents, including recent graduates, considered the amount of time allocated to anatomy education within their osteopathic programme as adequate. A recent survey revealed the mean number of hours dedicated to the teaching of anatomy within the current osteopathic programmes in Australia and New Zealand was 203.1 (SD \pm 59.0) [43]. This compares favourably with the mean number of hours of anatomy within American osteopathic education which was 210 hours in 2010 (109 hours for lectures or group activities, and 101 hours for practicals, laboratory, skills training activities) [5]. The present study included several historical osteopathic programmes. Participants who graduated from these programmes also reported favourable results in relation to anatomy teaching. This category included the University of Western Sydney, which produced graduates from 2002 until 2009, overseas trained participants, and practitioners from several small, private, independent colleges in Sydney, New South Wales in the 1980s.

Integration of curricula involves the removal of traditional boundaries between disciplines within the preclinical (predominated by the basic medical sciences), and subsequent clinical subjects [39,44,45]. In training clinicians, the integrated curriculum facilitates the incorporation of existing basic science knowledge with newly acquired clinical knowledge [46]. Associated with the move to integrated curricula has been a systemic-based approach to the teaching of anatomy, as opposed to the more traditional region-based approach (i.e. the thoracic region, the cranium, the lower limb, the pelvic region, etc) [47-49]. This non-traditional approach involves the integration of basic medical sciences applied to clinical concepts and is taught within a more clinically focused context [50]. Studies of Australian and New Zealand medical schools found that nearly all participating schools employed an integrated, systemic approach to the teaching of anatomy [41]. In contrast to medicine [39], all four current osteopathic programmes in Australia and New Zealand teach anatomy using a region-based approach [51,52]. This could be attributed to the regional approach of the osteopathic manipulative technique skills curricula, where it is convention to follow a region-based sequence [5].

The present study detected an association between university of graduation and participant responses (answers) in three of the theme-one statements (statements 1 to 5), which relates to anatomy knowledge and competent practitioners, specifically about participants' opinion of their level of anatomical instruction within their pre-professional osteopathic programme. Participant responses to one of the statements (statement 6) of theme-two (concerning anatomy content organisation-statements 6 to

9), were associated with university of graduation. This is not surprising as participants who graduated from the same university had studied the same osteopathic programme with the same anatomy syllabus. Most respondents (88.6%) agreed or strongly agreed with spreading the anatomy content throughout the osteopathic programme, as they can see the benefits of more anatomy content in the clinical years of osteopathic programmes. Participant responses to theme-three statements (concerning anatomy teaching resources available as part of their pre-professional programmes-statements 10 to 14) were associated with the university of graduation. This was expected as participants, who were studying at different universities would have had access to different anatomy teaching resources. The available anatomy teaching resources can greatly facilitate and scaffold students' learning of anatomy.

Participants in the present study expressed a preference for anatomy content to be spread throughout the entire curriculum. Implementing this would be difficult in an integrated curriculum [39,40]. This practice of integration (combining biomedical sciences with clinical subjects [44], assists students to clinically apply anatomy in their studies [53] and has been shown to increase anatomy knowledge retention [51,54]. Within the context of the overall curriculum, participants agreed that anatomy should be taught within a clinical context (statement 8). Bergman, et al. [32] outlines four contexts within which anatomy teaching is commonly employed in medical education. They are: clinical skills (physical examination), pathological, radiographic, and surgical procedures. The use of medical images (radiographs, CT scans, or MRIs) was commonly used in teaching anatomy within Australian and New Zealand osteopathic education, with 88.1% of respondents reporting access to medical images [43]. Medical students report a more positive approach to learning anatomy when it is taught within a clinical context as opposed to traditional curricula where it is taught as a standalone subject [55]. Context is closely related to learning where students' perceived relevance of the learning material can be a motivator for learning [56], hence, the findings of the present study are important, as the participants' perception of the relevance of anatomy can provide a strong motivator to learning.

In addition to context, availability of learning resources should also be considered. This study found that participants were provided with a range of anatomy learning and teaching tools as part of their osteopathic education (Table 5). This is similar to medical education [33,57,58] where teaching and learning tools include: dissection by students, inspection of prosected specimens, didactic face to face lectures, use of anatomy models, computer-based learning (such as, Virtual Reality (VR), Augmented Reality (AR), and 3-Dimension(3-D)), living anatomy (i.e. surface anatomy) and

radiological anatomy teaching [33,59,60]. All participants had access to most of these learning resources. Although living anatomy was not mentioned in the questionnaire, it is known that all osteopathic students regularly use living or surface anatomy as part of their acquisition of psychomotor skills in the learning of manual osteopathic technique procedures, where students regularly practice these procedures on each other as part of the learning process in class [61,62].

The use of cadavers in learning anatomy was considered positively by participants in the current study, a sentiment echoed by anatomists, clinicians and students alike [46,57,63,64]. Despite a strong preference by participants in the present study, for the use of cadaveric dissection over prosected specimens, only one of the four current osteopathic programmes in Australia and New Zealand include dissection as a compulsory component of pre-professional osteopathic training [43]. This is in contrast to the current state of medical education in Australia and New Zealand, where 75% of surveyed medical schools offer medical students the opportunity for human cadaver dissection [63]. Notwithstanding, all the current Australian osteopathic programmes, employ prosected cadavers as part of their anatomy teaching, while students enrolled in the only osteopathic programme in New Zealand, do not have access to cadaver specimens [43]. This is worthy of note, considering the ongoing debate around the benefits of dissection over prosection in learning anatomy [21,57].

In the current study, 88.1% of participants reported access to medical imaging as part of their learning of anatomy. This compares well with Canadian medical schools, where 13 of the 14 English-based schools indicated some degree of incorporation of radiology in their anatomy instructions [65]. This is supported by the literature where the benefits of using radiology in anatomy teaching have been well reported [66].

Even with advanced computer-based learning resources (VR, AR, & 3D), participants highly valued the use of cadavers in learning of anatomy. This is not surprising, as previous studies have reported similar findings [24,57,67,68]. An appreciation of the spatial or 3D relationships of anatomical structures is an important element in learning anatomy [69,70]. This has been one of the stated benefits of using dissection in learning anatomy [45,63,64]. Understanding the 3D nature of structures can be compromised with the use of computer-based learning tools [69,70]. Notwithstanding, participants valued the use of computer-based learning resources in learning anatomy, even though studies have demonstrated little benefit between using computer-based learning and use of plastic or physical 3D models in anatomy [71,72]. The development and inculcation of non-traditional, discipline-independent skills can be of benefit with the use

of cadavers in anatomy instruction [73].

Participants showed a clear preference for dissection and integrated curricula in learning anatomy. However, adopting an integrated program pedagogy that includes dissection is difficult to design and deliver, as the anatomy dissection is a separate subject, and can take up considerable time within a curriculum. This combination of integrated curricular and dissection is not reflected in the current anatomy syllabus within osteopathic education in Australia and New Zealand [43].

As the chiropractic profession shares a similar history to osteopathy, the trends and issues within anatomy training in chiropractic education are also relevant to osteopathy. Both professions use manual therapy to affect the musculoskeletal system [1,14,74]. In Australia, both professions have similar statutory regulation and scope of practice [75,76], as well as comparable educational requirements [77]. Given these similarities, challenges faced over anatomy teaching within chiropractic education are pertinent for osteopathic education. These concerns include the adaption of chiropractic anatomy curricula in response to the changing landscape of health professions education [57,78,79], and the calls for the establishment of minimum levels of anatomy knowledge for safe chiropractic practice [37]. Osteopathic education must also adapt to the rapidly evolving health care landscape, and curricular reform to produce graduates who are capable of providing relevant and effective health care well into the future.

The Covid-19 pandemic in 2020, required anatomical educators to rapidly transfer content delivery to a predominantly online environment [67,80,81]. These online delivery adaptations have generally been within reasonable timeframes, and considered as successful [57,67,80-95]. Despite previous opposition to more online delivery of the anatomy syllabus, the changes to delivery have become what is now referred to as the 'new normal.' The anatomy syllabus within osteopathic education programmes will need to adapt and evolve to take on more online methods of delivery within this new educational landscape, while not compromising educational quality. Although osteopathic practitioners were satisfied with their anatomy education, curricula must constantly evolve and should continually improve pursuant to developments in pedagogical research and clinical practice. A salient recommendation from the present study includes the establishment of a core anatomical curriculum for Australian osteopathic education, which can inform evidence-based osteopathic curricular design, as has been established in medical education [35,36].

Some limitations of this study included the relatively small sample size which may not accurately reflect the views

of the broader Australian osteopathic profession. As the more technologically based teaching resources were only more recently available, those osteopathic practitioners who studied for their pre-professional qualification more than 10 to 15 years ago would not have had easy access to many of the current learning tools. It is also not possible to measure the full effects of the Covid-19 pandemic. The passage of time will reveal whether these changes are ongoing.

This survey of Australian osteopathic practitioners confirms that anatomy is considered an important component of osteopathic education and essential for safe and competent practice. Participants consider as adequate their anatomy instruction as part of their pre-professional osteopathic education. These results can be used to inform and guide future osteopathic curricula designers, to ensure the anatomy syllabus is adequate for the training of safe and competent osteopathic practitioners. As anatomy teaching resources are the scaffolds for anatomy learning and teaching, special care should be taken in osteopathic programmes to provide appropriate discipline-specific educational resources.

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