Comparison of visual estimations of distal radius fracture radiographic parameters between different levels of orthopaedic doctors

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Medicine

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Declaration

I, Vishad Naidoo declare that this research report in the format of a "submissible" paper is my own, unaided work. It is being submitted for the Degree of Master of Medicine in the branch of Orthopaedic Surgery at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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18th day of July 2023 in Johannesburg

Student and co-author(s) declaration

Declaration: Student's contribution to article(s) and agreement of co-author/s)

I, Vishad Naidoo, student number: 0701303A, declare that this research report is my own work and that I contributed adequately towards research findings published in the article(s) stated below which are included in my research report

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.....Date: 24/04/2023

Name of Primary Supervisor:
Jason du Plessis

Signature of Primary Supervisor

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Article I:

Title: Comparison of visual estimations of distal radius fracture radiographic parameters between different levels of orthopaedic doctors.

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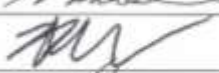
2nd author	Brenda Milner		10/05/2023
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Comments by Primary supervisor:

Dr Naidoo took an idea and made it his own. He performed all critical aspects well on his own and came up with a good paper worth bein published. Well done

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Nomenclature

AO…… Arbeitsgemeinschaft für Osteosynthesefragen

CEO…….……Chief Executive Officer

CHBAH…….Chris Hani Baragwaneth Academic Hospital

CMJAH……..…..Charlotte Maxeke Johannesburg Academic Hospital

HJH…….…….Helen Joseph Hospital

NHRD……...…National Health Research Database

PACS……..Picture Archiving and Communication system

"Submissible" format of a paper

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Vishad Naidoo: contributions to study design, data collection as well as analysis and interpretation of data. Jason du Plessis: contributions to concept and study design, oversight as well as critical appraisal and revision. Brenda Milner: Contributions in oversight, critical appraisal, key administrative elements and revision.

Sound scientific research practice

The manuscript, including related data, figures and tables, have not been previously published and is not under consideration elsewhere. No data have been fabricated or manipulated (including images) to support conclusions. This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time.

Plagiarism

The authors declare authorship of this article and that they have followed sound scientific research practice. This research is original and does not transgress plagiarism policies.

Conflict of interest statement

No conflict of interest to declare

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Compliance with ethical guidelines

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. Ethics clearance to conduct the study was obtained from the Human Research Ethics Committee (HREC), of the University of the Witwatersrand (M220430) as well as the National Health Research Database (NHRD) (GP202111055). Permission to conduct the study was also obtained from the departmental heads of departments (HODs) and chief executive officers (CEOs) of the three aforementioned hospitals. All the radiographs had any identifying information removed to protect patient confidentiality and ensure anonymity. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed written consent to participate in the study was obtained. All questionnaires were anonymous with no personal information except for rank in the relevant department.

Abstract

Background

Distal radius fractures are common injuries in South Africa. Accurate and decisive radiographic parameter interpretation is key in appropriate management. Digital radiographic facilities are rare in the public setting and goniometer usage is known to be low, thus, visual estimates are the primary form of radiographic assessment. Previous research has associated orthopaedic experience with accuracy of distal radius fracture parameter estimation but, oftentimes, doctors treating orthopaedic patients are not experienced in orthopaedics.

Methods

A cross-sectional questionnaire including four distal radius fracture radiographs was administered to 149 orthopaedic doctors at three Johannesburg teaching hospitals. Participants were grouped into ranks of: consultants (n = 36), registrars (n = 41), medical officers (n = 20) and interns (n = 52). Participants visually estimated values of distal radius fracture parameters, stated whether they would accept the position of the fractures and stated their percentage of routine usage of goniometers in real practice.

Results

The registrar group was most accurate in visually estimating radial height ($p = 0.0237$), while the consultant, registrar and medical officer groups were equally as accurate in estimating radial inclination. The consultant and registrar group were equally accurate at estimating volar tilt, whilst the medical officer and intern groups were least accurate ($p < 0.0001$). The intern group were also the least accurate in estimating radial height and radial inclination ($p < 0.0001$). The Gwet's AC agreement was 0.1612 ($p = 0.047$) for acceptance of position of the first radiograph, 0.8768 ($p < 0.0001$) for the second, 0.8884 ($p < 0.0001$) for the third and 0.8064

($p < 0.0001$) for the fourth. All groups showed no difference in goniometer usage, using them largely 0-25% of practice ($p = 0.1937$).

Conclusion

In the study, it was found that accuracy in visual estimations of distal radius fracture parameters was linked to orthopaedic experience but not linked to routine practice goniometer usage, which was minimal across all groups. Inter-rater agreement on acceptability of fracture position is potentially dependent on severity of deviation from acceptable parameters.

Keywords: Distal radius, X-ray comparison, orthopaedic experience

Level of evidence: level 3

1. Introduction

Distal radius fractures are common injuries, constituting a significant portion of orthopaedic trauma presentations and were first formally documented and described by Abraham Colles in 1814. [1,2] These injuries most commonly result from falls onto outstretched hands in the extended and pronated position, where the relatively thinner dorsal cortex buckles under axial stress while the volar cortex fractures under tensile stress with about 50% of these fractures being intra-articular.[3] There is a bimodal age-distribution of prevalence, whereby, in younger individuals, the most common mechanisms are falls from height or other high energy incidents such as motor vehicle accidents.[4] The most common mechanism in elderly individuals is lower energy events such as falls from a standing height, owing to their relative osteopaenia.[4] Other risk factors for distal radius fractures are female gender and early menopause.[5]

Effective and appropriate management of these fractures is vital in the recovery to pre-morbid function for patients. Management can be operative or non-operative and decisions on the most suitable management for a fracture are multifaceted in nature. Patient dependant factors that influence the management decision include: age, occupation, patient physiological health and wrist radiographic parameters. External factors include the availability of limited operating-theatre time, facility resources and, importantly, the decisive interpretation of radiographic parameters. Irrespective of whether a distal radius fracture is managed operatively or non-operatively, mismanaged distal radius fractures can lead to substantial levels of patient morbidity due to long term loss of hand and wrist function, as well as chronic pain along with associated personal and occupational harm.[3]

In the clinical setting, the assessment of distal radius fractures includes the radiographic evaluation of radial height, radial inclination and volar tilt (see *Figure 1*). [3] Acceptable ranges of these parameters, for non-operative management as per the *Arbeitsgemeinschaft für Osteosynthesefragen* (AO) foundation, are radial height of 7 – 14mm, radial inclination of 17

– 22º and volar tilt of 11º volar to neutral 0º. [6-11] Although acceptable ranges are well described, there is an inter-institutional and individual based variability that exists of what is deemed to be a radiographically acceptable position. [12,13]

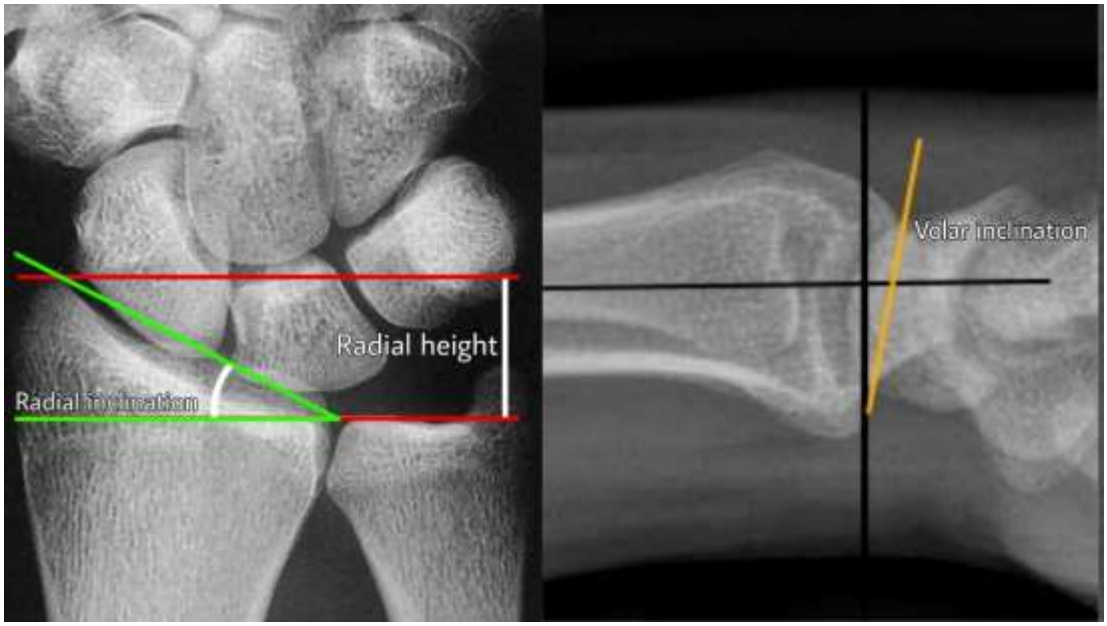

Figure 1: Distal radius radiographic parameters

In the South African setting, it is not always the case that an orthopaedic-trained professional makes the assessment and final management decision on orthopaedic cases that present to the emergency departments. This circumstance is especially prevalent, in more peripheral facilities within non-urbanised regions, which make up a large proportion of facilities in the country. In these situations, the medical officers on duty at the respective emergency departments make management decisions which includes the interpretation of radiographic parameters. Some of these professionals may be immediately post-internship, highlighting the potential lack of any further orthopaedic training supporting decision making for management of orthopaedic injuries.

The interpretation of radiographic parameters can be done either with a naked eye, with the use of goniometers and rulers, or with digital radiographic measurements. Visual estimates have been found to be less accurate in the interpretation of distal radius radiographic parameters, compared to digital measurements, especially as it pertained to management decision making as reported in a United Kingdom study.[14] There was also a positive association found between the accuracy of estimates, and the number of years of orthopaedic experience.[15, 16] However, a 2015 study in the United States of America found that, although the number of years of experience was associated with more accurate visual estimates of radiographic measurements, consultants who did not regularly treat distal radius fractures tended to fair more poorly than those who did. [17] Moreover, a lack of provided reference points for visual measurements, resulted in poorer estimates, specifically in less experienced professionals. [17] This finding was much less likely to be an indication of inferior estimation ability but rather a lack of knowledge of which bony landmarks to measure from. It is important to acknowledge, that the usage of fluoroscopy by orthopaedic surgeons, during theatre procedures largely precludes the usage of any measurement tool, relying solely on visual estimates for assessment of radiographic fracture parameters. A Netherlands based study found that visual estimates of distal radius radiographic parameters with provided bony landmark-template lines were more accurate compared to estimates without them, even amongst orthopaedic trained individuals.[18] This finding highlights the impact of ability to use visual-measurement aids such as lines from rulers and goniometers. Goniometers and rulers have generally been found to be a more accurate form of measurement of radiographic parameters than visual estimates, and were equally as accurate as digital measurements. [15-20]

Many South African public sector hospitals do not have access to digital radiographic facilities and many professionals do not habitually use goniometers and rulers in practice. [19] This would spotlight the reliance on visual estimation of parameters of plain radiographs. Furthermore, radiograph films are rarely printed at a 100% magnification, which is essential for accurate

goniometer and ruler usage and interpretation. There is a paucity of literature comparing the pure visual estimation of parameters of distal radius radiographs to digital measurements, with none performed in the South African setting.

Therefore**,** the aim of the study is to compare the accuracy of visual estimations of distal radius fracture radiographic parameters, between different levels or ranks of orthopaedic doctors, to explore any differences between levels on whether they deem the positions of distal radius fractures to be acceptable or not, to ascertain the proportion of routine goniometer usage in real practice time and to potentially provide recommendations around the routine use of measuring tools in determining an acceptable reduction and training around it.

2. Methods

The study was a questionnaire-based cross-sectional study conducted at the Orthopaedic Surgery Departments of the three main University of the Witwatersrand's academic hospitals namely: Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), Chris Hani Baragwaneth Academic Hospital (CHBAH) and Helen Joseph Hospital (HJH). The study population included the interns, medical officers, registrars and consultants treating orthopaedic patients at the respective hospitals. A total of 149 volunteers participated in the study including: 36 consultants, 41 registrars, 20 medical officers and 52 interns.

Four radiographs of distal radius fractures were procured and prepared from the Picture Archiving and Communication System (PACS), available at one of the abovementioned teaching hospitals. The radiographs were selected for ease of interpretation with the position of all four radiographs being outside the acceptable AO-defined parameters ranging from mildly displaced to severely displaced fracture configurations. The radiographs depicted template measurement lines for the parameters of radial height, radial inclination and volar tilt.

All images included scale bars, along with blank spaces for participants to fill in parameter values.

The questionnaires (see Appendix A) were administered to volunteers of the respective Orthopaedic Surgery Departments of the hospitals after an explanation was provided as to the nature and purpose of the study (Appendix B) followed by elaboration of the relevant parameters with AO-defined acceptable values provided. Instructions were given for measurements to be purely visually estimated without any assistance of equipment or other means. The questionnaire also asked whether the participant considered the fracture position of each radiograph to be acceptable or not. A final question asked about the participant's goniometer usage in real life practice with options of either 0-25%, 25-50%, 50-75% or 75-100% of the time. Data were grouped according to the participant's professional rank in the department. Consent to participate was obtained (Appendix C) and data were kept anonymous except for documentation of rank in the department namely intern, medical officer, registrar or consultant.

Questionnaire sheets were stored securely and electronic copies were made and stored securely to ensure the safety of the data. Data were captured, collated and prepared for statistical analysis on Microsoft Excel (Microsoft, Seattle, Washington).

2.1. Data analysis

De-identified data were organised on a Microsoft Excel spreadsheet (Microsoft, Seattle, Washington). Data were analysed using Stata 15 (StataCorp. 2017. Stata Statistical Software: release 15. College Station, TX: StataCorp LP), as well as GraphPad Prism 9.0 (GraphPad Software, Inc., San Diego, CA).

P-values < 0.05 with a 95% confidence level were considered as statistically significant. Statistical assumptions such as normal distribution of the data were tested to ensure these assumptions were not violated during data analysis.

The sample size required for the study was calculated using the OpenEpi toolkit (https://openepi.com/SampleSize/SSPropor.htm). A minimum sample size of 139 participants with a power of 80% at a 0.05 alpha level was required.

The differences between visual estimate readings and baseline PACS values were analysed using the Kruskal-Wallis test for non-parametric data with Dunn's post tests, and a Chi-square test was used to compare goniometer usage percentages between groups.

Gwet's AC1 agreement coefficient was used to measure the agreement between the groups as it incorporates both the number of rating categories and the frequency with which they are used by the raters. Agreement coefficients apply to the case of multiple raters or groups, multiple rating categories, any level of measurement, and in the presence of missing values. Gwet's coefficient is superior to alternative agreement measures as it most closely resembles percentage agreement. Standard errors are estimated based on concepts for finite population inference, and the uncertainty associated with the estimated coefficients is accounted for by a probabilistic benchmarking method for strength of agreement.

Table. I: Gwet's co-efficient ranges and associated strength of agreement

Gwet's AC1 Co-efficient	**Strength of agreement**
<0.20	Poor
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 – 1.00	Very good

3. Results

Figure 2 shows the differences in collective radiograph visual estimates from the collective baseline PACS values for radial height between the four groups. The consultant group showed a mean difference to baseline PACS value of 3.65mm (SD 2.93mm) for radial height, the registrars showed a mean difference of 2.48mm (SD 2.07mm), the medical officers showed a mean difference of 3.53mm (SD 2.46mm) whilst the interns showed a mean difference of 5.29mm (SD 4.54mm). The registrar group had the lowest collective mean difference to baseline PACS values for radial height, amongst the groups, which was statistically significant to the consultant group ($p = 0.005$), the medical officer group ($p = 0.0237$) and the intern group ($p = 0.0001$). The consultant, medical officer as well as intern groups were not statistically significant from each other. The consultant group showed a mean collective underestimation of 1.28mm (SD 4.51mm) (24.10%), between all radiographs, with 40.47% of the group generally overestimating and 59.53% generally underestimating. The registrar group showed a mean collective underestimation of 0.88mm (SD 3.11mm), (13.99%), with 50.25% of the group overestimating and 49.75% underestimating. The medical officer group showed a mean collective underestimation of 1.95mm (SD 3.85mm) (41.62%), with 35.00% of the group overestimating and 65.00% underestimating. The intern group showed a mean collective underestimation of 1.79mm (SD 6.75mm) (49.79%), with 28.86% of the group overestimating and 71.14% underestimating.

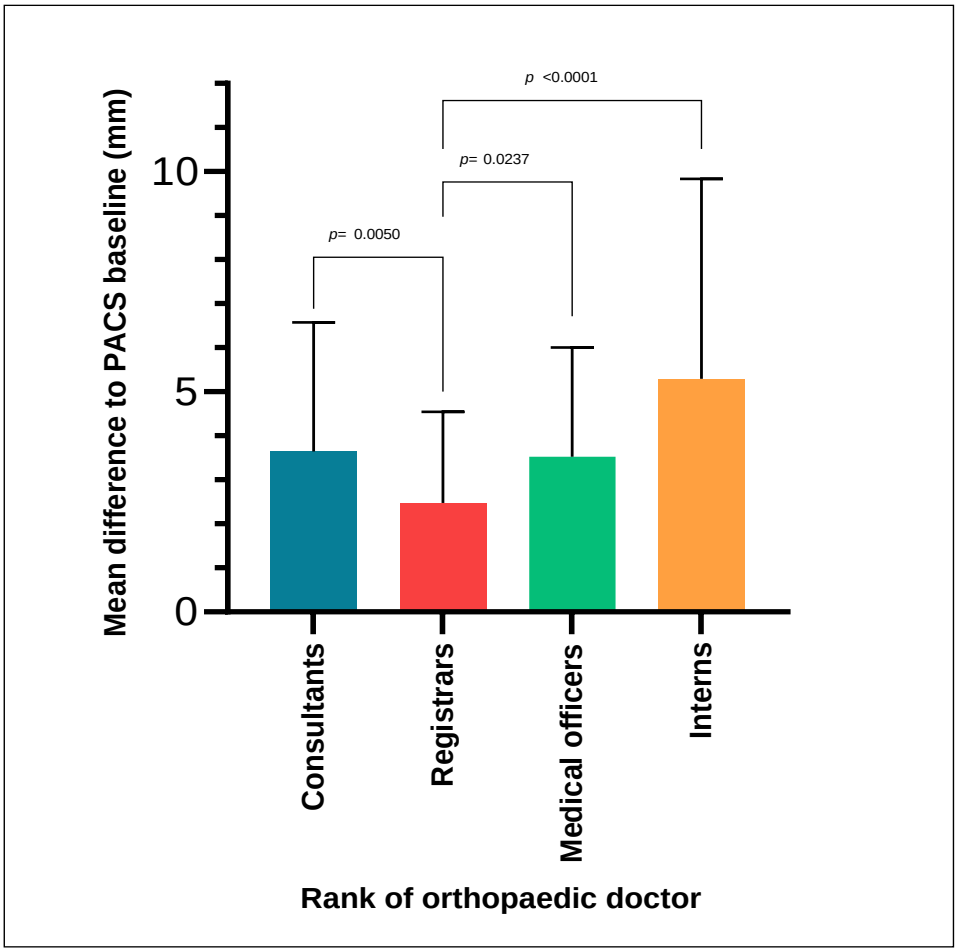

Figure 2: Mean difference to PACS baseline: radial height

In *Figure 3*, the consultant group showed a collective mean difference to PACS of 3.93º (SD 4.18º) for radial inclination, the registrars showed a mean difference of 4.56º (SD 3.66º), the medical officers showed a mean difference of 6.05º (SD 6.48º) whilst the interns showed a mean difference of 8.99º (SD 9.38º). The consultant, registrar and medical officer groups were not statistically different from each other but were all significantly more accurate than the intern group ($p < 0.0001$). The consultant group showed a mean collective overestimation of 1.67º (SD 5.06º) between all radiographs, with 43.89% of the group generally overestimating and 56.11% generally underestimating.

The registrar group showed a mean collective overestimation of 0.59º (SD 5.83º), with 56.71% of the group overestimating and 43.29% underestimating. The medical officer group showed a mean collective underestimation of 3.30º (SD 8.24º), with 42.50% of the group overestimating and 57.50% underestimating. The intern group showed a mean collective underestimation of 2.81º (SD 12.69º), with 44.71% of the group overestimating and 55.29% underestimating.

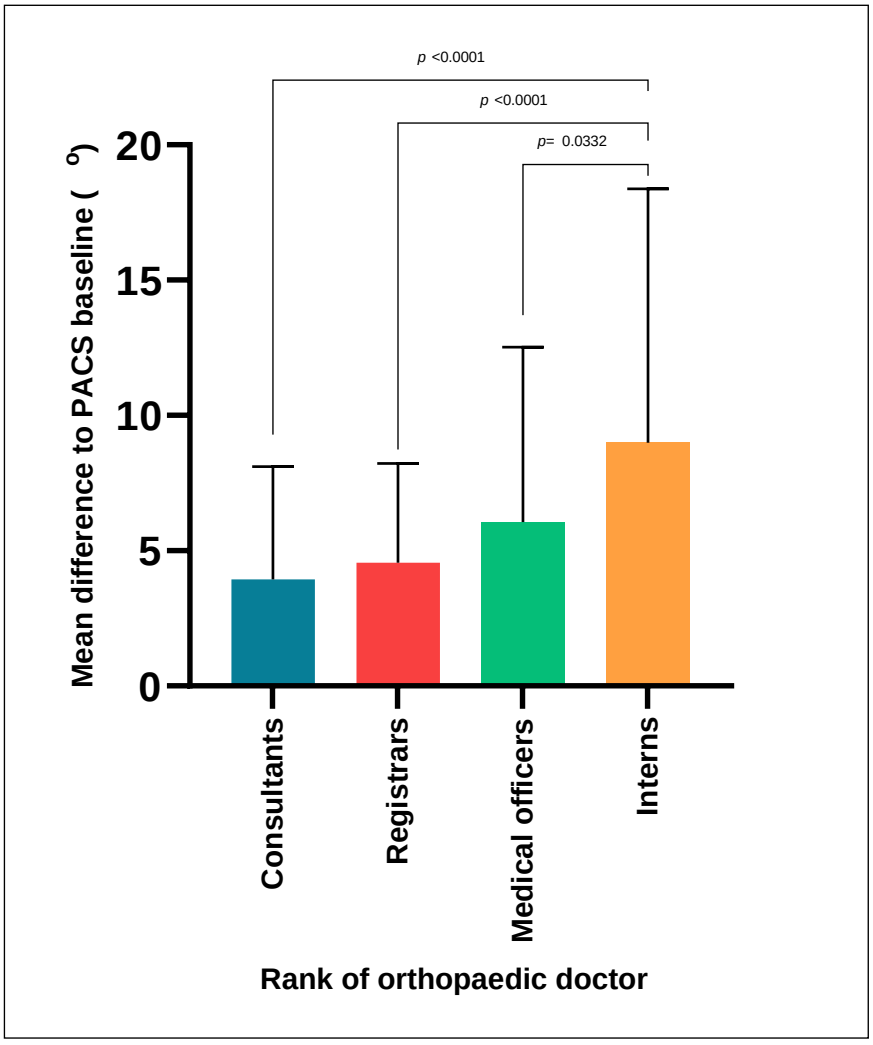

Figure 3: Mean difference to PACS baseline: radial inclination

Shown in *Figure 4*, the consultant group showed a collective mean difference to PACS of 6.99º (SD 6.25º) for volar tilt, the registrars showed a mean difference of 6.09º (SD 5.29º), the medical officers showed a mean difference of 12.78º (SD 9.53º) whilst the interns showed a mean difference of 15.97º (SD 12.58º). The consultant and registrar groups were not statistically significant from each other but both were significantly more accurate than the medical officer group ($p < 0.0001$) and the intern group ($p < 0.0001$). The medical officer and intern groups were not statistically significant from each other. The consultant group showed a mean collective underestimation of 0.39º (SD 7.84º) between all radiographs, with 52.78% of the group generally overestimating and 47.22% generally underestimating. The registrar group showed a mean collective overestimation of 1.43º (SD 7.95º), with 49.39% of the group overestimating and 50.61% underestimating. The medical officer group showed a mean collective of 5.98º (SD 14.83º), with 66.25% of the group overestimating and 33.75% underestimating. The intern group showed a mean collective underestimation of 3.59º (SD 20.04º), with 44.23% of the group overestimating and 55.77% underestimating.

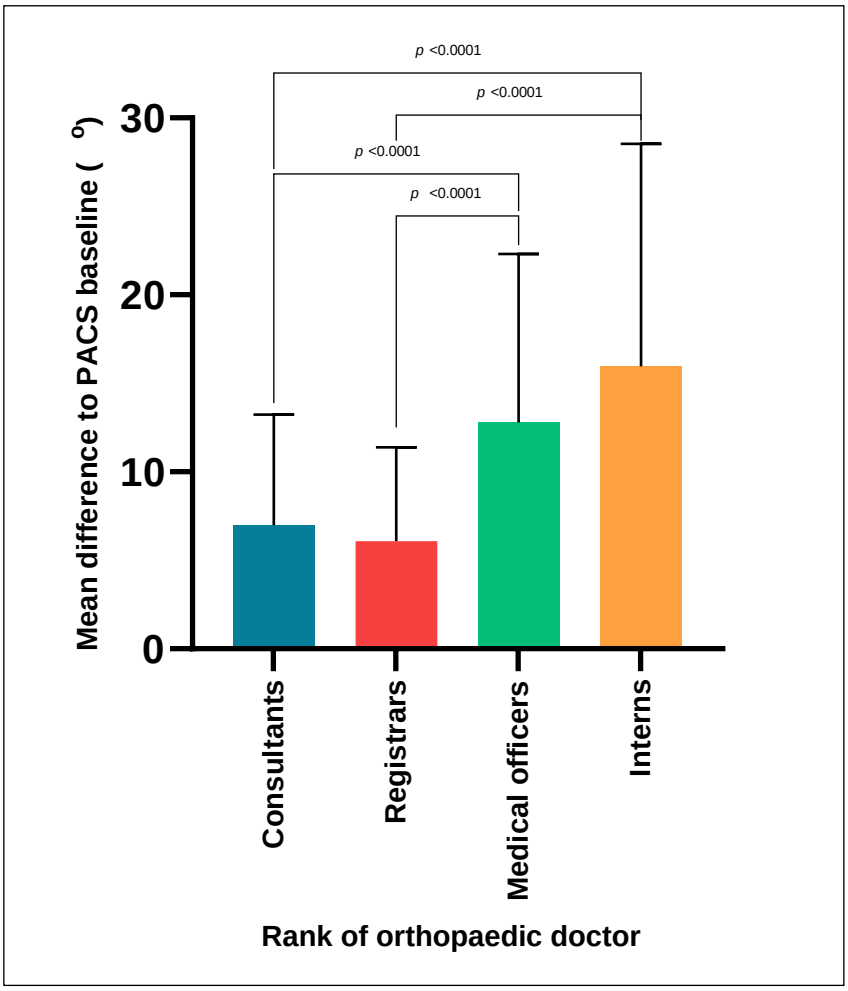

Figure 4: Mean difference to PACS baseline: volar tilt

Table II compiles the results of choices of whether to accept or not accept positions in the four different radiographs between the four study groups. The consultant group had 11.11% (n = 4) accepting the position of radiograph 1, 2.78% (n = 1) accepting the position of radiograph 2, 0.00% (n = 0) accepting the position of radiograph 3 and 11.11% (n = 4) accepting the position of radiograph 4. The registrar group had 21.95% (n = 9) accepting the position of radiograph 1, 21.95% (n = 9) accepting the position of radiograph 2, 17.07% (n = 7) accepting the position of radiograph 3 and 19.51% (n = 8) accepting the position of radiograph 4. The medical officer group had 65.00% (n = 13) accepting the position of radiograph 1, 14.29% (n = 2) accepting

the position of radiograph 2, 10.00% (n = 2) accepting the position of radiograph 3 and 45.00% (n = 9) accepting the position of radiograph 4. The intern group had 69.23% (n = 36) accepting the position of radiograph 1, 7.69% (n = 4) accepting the position of radiograph 2, 9.615% (n = 5) accepting the position of radiograph 3 and 28.85% (n = 15) accepting the position of radiograph 4. The Gwet's AC agreement coefficient of the four study groups for the choices of whether to accept or not accept the positions of each radiograph were 0.1612 ($p = 0.047$) for radiograph 1, 0.8768 ($p < 0.0001$) for radiograph 2, 0.8884 ($p < 0.0001$) for radiograph 3 and 0.8064 ($p < 0.0001$) for radiograph 4.

Table II: Agreement on whether to accept or not accept radiograph positions

Rank of orthopaedic doctor	**Radiograph 1**		**Radiograph 2**		**Radiograph 3**		**Radiograph 4**	
	Accept	**Don't Accept**	**Accept**	**Don't Accept**	**Accept**	**Don't Accept**	**Accept**	**Don't Accept**
Consultants (*n*=36)	4	32	1	35	0	36	4	32
Registrars (*n*=41)	9	32	9	32	7	34	8	33
Medical officers (*n*=20)	13	7	2	13	2	18	9	11
Interns (*n*=52)	36	16	4	48	5	47	15	37
Gwet's AC1 agreement	0.1612 ($p = 0.047$)		0.8768 ($p < 0.0001$)		0.8884 ($p < 0.0001$)		0.8064 ($p < 0.0001$)	
Level of agreement	**Poor**		**Very good**		**Very good**		**Good**	

Presented in *Figure 5* are the percentages of usage of goniometers in real practice between the study groups, categorised into four categories namely usage between 0-25%, 25-50%, 50-75% or 75-100% of total time in orthopaedic practice. The consultant group had 87.88% in the 0-25% category (n = 31), 5.05% in the 25-50% category (n = 2), 2.02% in the 50-75% category (n = 1) and 5.05% in the 75-100% category (n = 2). The registrar group had 86.87% in the 0-25% category (n = 35), 9.09% in the 25-50% category (n = 4), 0.00% in the 50-75% category (n = 0) and 4.04% in the 75-100% category (n = 2). The medical officer group had 95.00% in the 0-25% category (n = 19), 5.00% in the 25-50% category (n = 1), 0.00% in the 50-75% category (n = 0) and 0.00% in the 75-100% category (n = 0). The intern group had 100% in the 0-25% category (n = 52), 0% in the 25-50% category (n = 0), 0.00% in the 50-75% category (n = 0) and 0.00% in the 75-100% category (n = 0). There was no statistically significant difference (p = 0.1937) between the four usage categories in the four study groups with all of them largely using goniometers 0-25% of the time in orthopaedic practice.

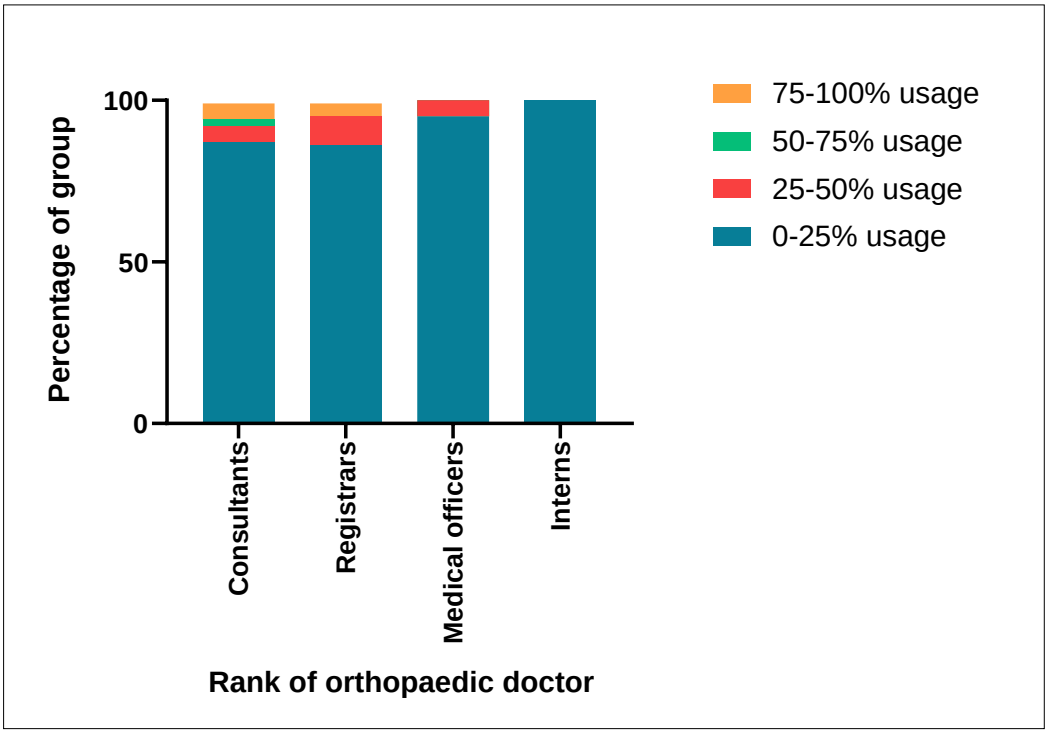

Figure 5: Percentage of time of goniometer usage in real practice

4. Discussion

The study set out to compare the accuracy of visual estimations of distal radius fracture parameters between different levels of orthopaedic doctors in the South African public health care setting, where digital imaging via a PACS is a scarcity and where routine goniometer usage may be at a minimum.

The intern group showed the lowest accuracy, with the highest mean difference to baseline PACS values, in visually estimating all three distal radius fracture radiographic parameters namely radial height, radial inclination and volar tilt. The registrars and consultants generally performed most accurately whilst the medical officer group fell generally in-between. These findings could infer some association between orthopaedic experience, implied by rank, and accuracy in visual estimations of distal radius fracture parameters. Previous research has found that the number of years of orthopaedic experience is positively correlated with accuracy of distal radius fracture parameter visual estimates, which may essentially be paralleled in our results.[14]

The results showed an overwhelming predilection to minimal goniometer usage in real practice, of 0-25%, with no statistical differences across all four groups. Considering the differing levels of accuracy between groups in visually estimating distal radius parameters, it appears, on the surface, accuracy is unlikely to be associated with routine goniometer usage. However, it is important to appreciate the differences in goniometer experience between different study groups as well as between individuals who fall within each usage percentage groups.

Inter-group agreement between the four study groups on their choices of whether to accept or not accept the positions of the radiographs respectively, were found to be poor for radiograph 1, very good for radiograph 2 and 3 and good for radiograph 4. There may be several factors influencing an individual doctor's choice to accept or not accept the position of a distal radius

fracture radiograph that could explain these results. Some of these factors may include years of experience, personal preference, level of training, inter-institutional protocols and resource constraints whilst excluding patient related factors such as age, co-morbidities, occupation and handedness which did not feature in the study design. Furthermore, there may be elements of cross-interaction of these factors that may have resulted in the gross differences between the groups' choices.[6] Radiograph 1 could be considered as the most visually contentious or borderline image, deviating the least from the AO-defined acceptable parameters, which may have led to the low agreement co-efficient value within the study groups on whether to accept the position or not. Notably, radiograph 1 is still outside of the AO-defined acceptable parameters and thus would ultimately be considered an unacceptable position. Radiograph 2, 3 and 4 could be considered visually more severely outside of the AO-defined acceptable parameters, thus possibly explaining the higher agreement co-efficient values for those radiographs as their respective positions are substantially more visually unacceptable compared to radiograph 1. This finding may highlight that, although more overtly unacceptably positioned distal radius fractures are easier to define via visual estimations, more subtly unacceptably positioned distal radius fractures could be missed and potentially mismanaged, especially by less experienced doctors.

4.1. Study limitations

The three teaching hospitals included in this study all fall under a single training institution which may drive certain common management strategies or philosophies that may not necessarily represent other institutions or the country as a whole.

The association of number of years of experience in orthopaedics with accuracy of visual estimations of distal radius fracture parameter as well as comparison of visual estimates with and without provision of measurement lines have been explored previously, and were not

considered in our analysis. Addressing these points, especially when noting that the medical officer group was the smallest, with highest variability with levels of experience, may have added insight and representativity to our results and could potentially be explored in further research. [14,17]

4.2. Recommendations

Interns often find themselves responsible for management decision making for orthopaedic patients immediately post internship and it can be suggested, based on our findings, that interns receive more focussed teaching and exposure to assessment of radiographs, especially distal radius radiographs, owing to the high prevalence of the injury.

Additionally, and especially for interns, attentive training and encouragement for the use of goniometers in practice could assist in improving radiographic parameter assessment accuracy at their level, especially in resource constrained settings without any digital radiographic measurement facilities.

5. Conclusion

There was a positive association found between more experienced orthopaedic doctor ranks and the ability to accurately visually estimate distal radius fracture parameters. However, there appeared to be no clear relation found between goniometer usage and accuracy in visual estimates. Inter-rater agreement on acceptability of fracture position may be dependent on how visually severely it deviates from AO-defined acceptable parameters.

Conflict of interest

No conflict of interest to declare.

Ethical statement

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. Ethics clearance to conduct the study was obtained from the Human Research Ethics Committee (HREC), of the University of the Witwatersrand (M220430) as well as the National Health Research Database (NHRD) (GP202111055). Permission to conduct the study was also obtained from the departmental head of departments (HODs) and chief executive officers (CEOs) of the three aforementioned hospitals. All the radiographs had any identifying information removed to protect patient confidentiality and ensure anonymity. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed written consent to participate in the study was obtained. All questionnaires were anonymous with no personal information except for rank in the relevant department.

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Appendices

Appendix A: Study questionnaire

1. Below are 4 sets of radiographs of wrists with distal radius fractures, printed with a 10mm increment scale bar. This is for the purpose of assessment and comparison of visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals.

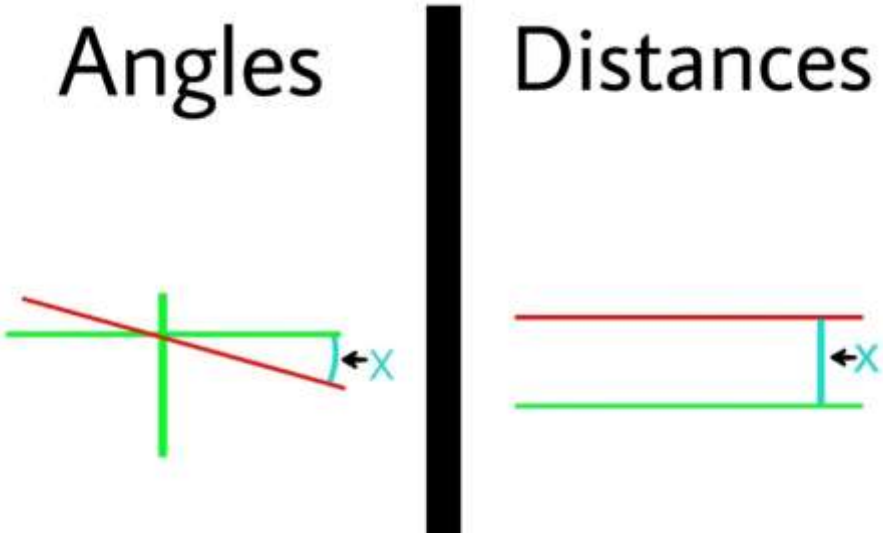
2. There is a measured parameter on each of the radiographs, of either an angle or a distance as demonstrated on the instructional image, below.

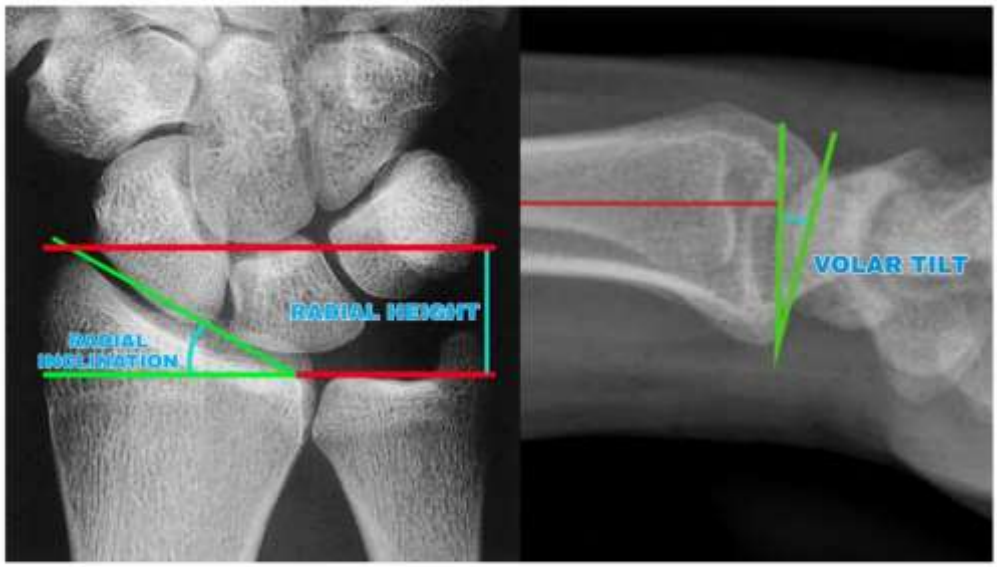
3. Values that are entered must be unassisted, and purely visual estimations, without use of equipment.

4. Fill in your answers, with a black pen, what you estimate the angles or distances to be, with whole numbers, (no decimals) with either positive or negative values.

5. Lastly, enter a YES or NO, as to whether you would find the position acceptable as per the AO-defined normal value ranges.

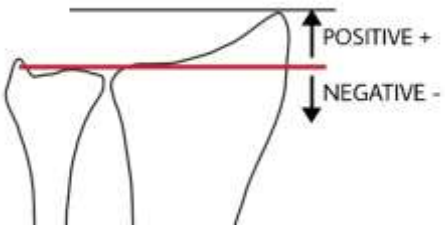
6. A scale bar is provided indicating 10mm intervals, in each image.



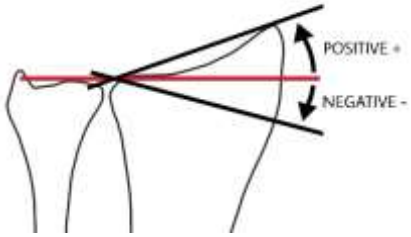


AO DEFINED NORMAL VALUE RANGES:

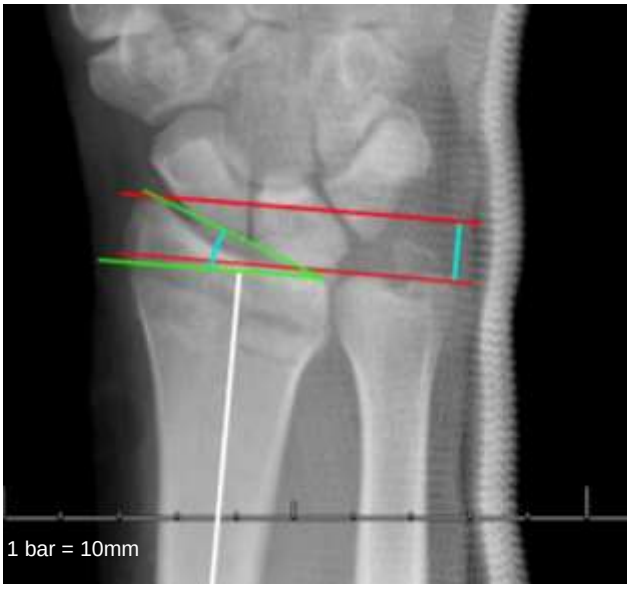
<u>RADIAL HEIGHT</u>: +8mm to +14mm (positive value when radial styloid is distal to distal ulna level, and negative value when the radial styloid is proximal to the distal ulna level)

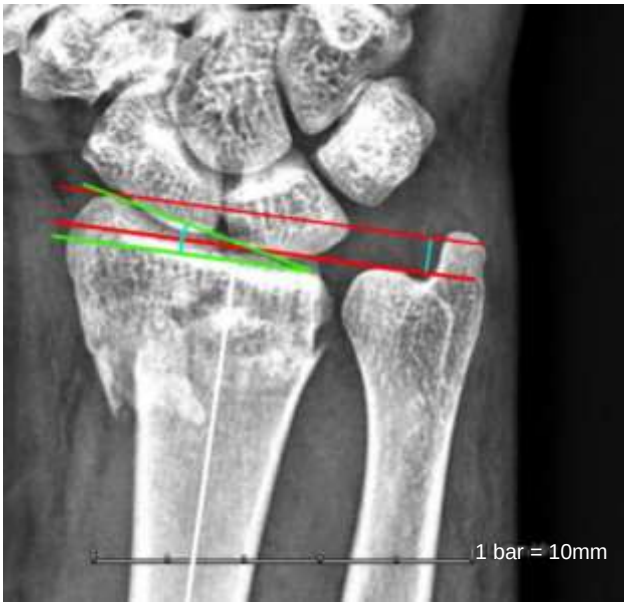
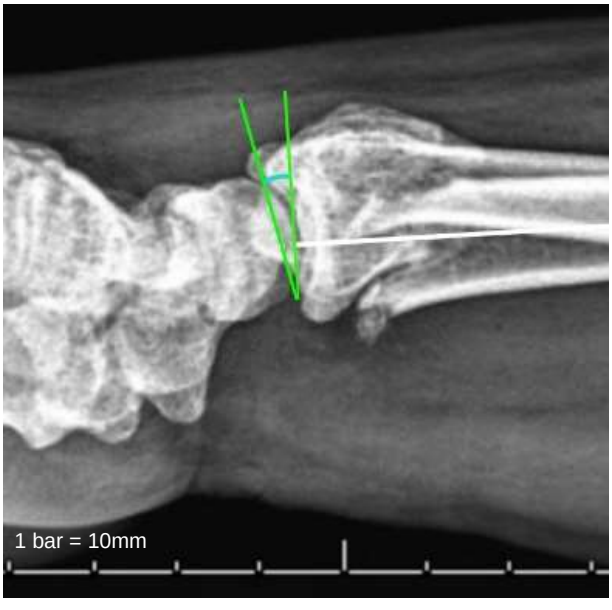


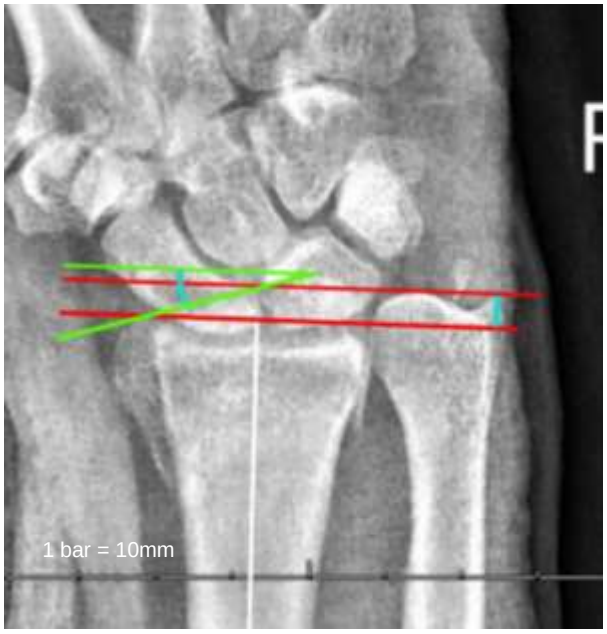
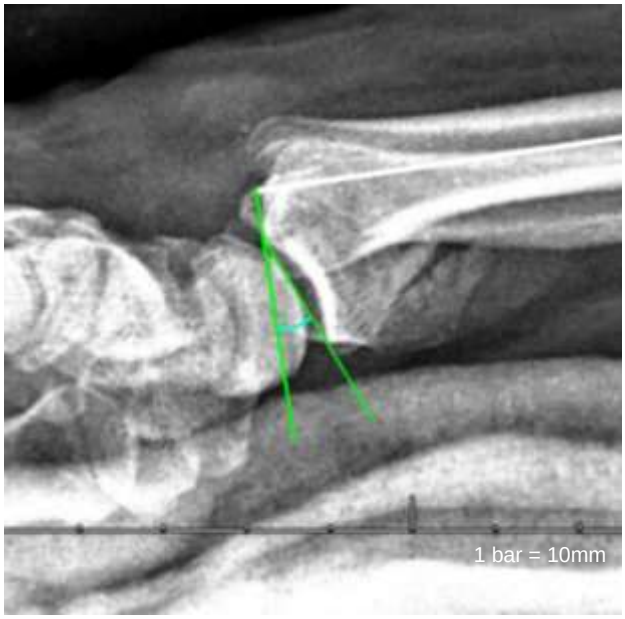
<u>RADIAL INCLINATION</u>: +17^{O} to +22^{O} (Positive value when angle is distal to distal ulnar level, negative when angle is proximal to distal ulnar level)



Percentage goniometer usage in real life practice?	0-25%___	25-50%___	50-75%___	75-100%___

XRAY 1	
AP	LATERAL
	
RADIAL HEIGHT:____mm / RADIAL INCLINATION:___°	TILT:_____°
ACCEPTABLE POSITION, YES/NO?_____	

XRAY 2	
AP	LATERAL
	
RADIAL HEIGHT:____mm / RADIAL INCLINATION:___°	TILT:_____°
ACCEPTABLE POSITION, YES/NO?_____	

XRAY 3		
AP		LATERAL
		
RADIAL HEIGHT:____mm	RADIAL INCLINATION:___°	TILT:_____°
ACCEPTABLE POSITION, YES/NO?_____		

XRAY 4		
AP		LATERAL
		
RADIAL HEIGHT:____mm	RADIAL INCLINATION:___°	TILT:_____°
ACCEPTABLE POSITION, YES/NO?_____		

Appendix B: Study information sheet

STUDY INFORMATION DOCUMENT

Study title: "Comparison of visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals"

HREC approved number: M220430

NHRD approved number: GP202111055

Dear colleague.

My name is Vishad Naidoo, a registrar in the Department of Orthopaedic Surgery (W-13-01-40). I appreciate your willingness consideration to participate in this study

Distal radius fractures are common injuries, and, are encountered by all levels of doctors at all levels of health facilities. Optimal management decisions involve adequate interpretation of wrist radiographic parameters. Often times, there are no tools routinely used to assess radiographic parameters in the way of digital measurement, goniometers and 100% magnification x-rays, thus, visual estimations of radiographic parameters are commonly used.

The aim of the study is to assess the accuracy of visual estimates of distal radius fracture radiographic parameters and potential differences, therein, between levels of orthopaedic professionals. We intend to determine whether an acceptable reduction can be determined accurately without measuring tools based on predetermined acceptable criteria and to provide recommendations around the routing use of measuring tools in determining an acceptable reduction.

We are asking / inviting you to take part in a research study

It requires no tools nor special equipment. Images of wrist radiographs are attached with measurement lines of angles and distances with blanked values. Measurement estimates for those blanked values need to be made based on pure visual mean, without any assistance, and need to be completed in the spaces provided on the answer sheet.

Participation is voluntary. Refusal to participate will involve no penalty nor risk, or loss of benefits to which the Participant is otherwise entitled. The Participant may discontinue participation at any time without penalty, or loss of benefits to which the Participant is otherwise entitled; that there is no

requirement to provide a reason for withdrawing and any data collected on such a person will in default be destroyed, unless the Participant specifically consents to its retention.

Reimbursement: There is no reimbursement involved in participating the study.

Confidentiality: Normally personal information will be treated in the strictest confidence and will only be available to the Principal Investigator (PI) and his/her supervisor, in the case wherein the PI is a postgraduate student. The only exceptions - and all of them are rare - would normally be:

1. Personal information may be disclosed if required by law
2. The Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit

Contact details of researcher/s:
Principle investigator: Dr Vishad Naidoo: vishadnaidoo@gmail.com
Main supervisor: Dr Jason du Plessis: jasondp_29@yahoo.com
Secondary supervisor: Dr Brenda Milner: Brenda.Milner@wits.ac.za

Outputs

The results of the study will provide a picture of the accuracy of any differences in visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals and provide insight into adequacy of treatment and education around treating these injuries.

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Date: April 2022

Appendix C: Participant consent form

WITS UNIVERSITY

PARTICIPANT CONSENT SHEET

Comparison of visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals.

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study I am free to speak to any of these contacts.

Contact details:

Principal Investigator: Dr V Naidoo 0724604535, vishadnaidoo@gmail.com

Supervisor Dr J du Plessis 082 445 7247 jasondp_29@yahoo.com

Dr CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.
Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____
Hospital _____
Level or rank in department:_____
Date: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

Appendix D: CEO CHBAH permission letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 15th February 2022

TITLE OF PROJECT:

Comparison of visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals.

UNIVERSITY: Witwatersrand

Principal Investigator: Dr V Naidoo

Department: Orthopaedics

Supervisor : Dr J Du Plessis

Permission Head Department (where research conducted): Yes

NHRD No. 202111_055

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- **Permission having been granted by the Committee for Research on Human Subjects of the University of Witwatersrand.**
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

Recommended
(On behalf of the MAC)
Date: 15/02/2022

Approved/~~Not Approved~~
Hospital Management
Date: 16/02/2022

Appendix E: CEO CMJAH permission letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL (CMJAH)
OFFICE OF THE SENIOR CLINICAL MANAGER

Enquiries: *Ms N. Mzila*
Email: Nolwazi.Mzila@gauteng.gov.za
Tel: *011 488 3365*
Ref: *1/7/2*
Date: 19 July 2022

GP_202111_055

Dear Vishad Naidoo

RE: PROVISIONAL APPROVAL OF STUDY

TITLE: COMPARISON OF VISUAL ESTIMATIONS OF DISTAL RADIUS FRACTURE RADIOGRAPHIC PARAMETERS BETWEEN DIFFERENT LEVELS OF ORTHOPAEDIC DOCTORS

Permission to conduct the above-mentioned study is provisionally granted subject to:

1. Submitting an Ethics Clearance Certificate from the University of Witwatersrand Human Research and Ethics Committee (HREC).

Please submit the above documents at your earliest convenient within 3 months from the date of this letter. This will prompt the Chief Executive Officer (CEO) of Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) to grant you a final approval. It is important to note that your research can only commence once a final approval is granted. Failure to comply with the above-stated requirements may result in the withdrawal of your application.

Supported / ~~Not Supported~~

Dr J. Punwasi
Senior Clinical Manager

Approved / ~~Not Approved~~

Ms. G Bogoshi
Chief Executive Officer: CMJAH

Appendix F: CEO HJH permission letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Gauteng Department of Health
Helen Joseph Hospital
Enquiries: Dr. M. Mukansi
Research Committee: Chairperson
Tel :(011) 489-0306/1087
Fax :(011) 489 1038
E mail:Murimisi.mukansi@wits.ac.za

2 March 2022

To whom it may concern

Subject: HELEN JOSEPH HOSPITAL RESEARCH COMMITTEE APPLICATION

PROTOCOL TITLE: Comparison of visual estimations of distal radius radiographic parameters between different levels of Orthopaedic professionals.

Principal Investigator: Dr. Vishad Naidoo

Ethics Clearance: Pending

Co- investigator: Dr. Vishad Naidoo

Department: Helen Joseph Hospital

Committee Recommendations
The Committee is giving you Conditional access while awaiting the final ethical clearance certificate from the University of Witwatersrand.

It is the duty of the researcher to collect the data to the relevant department after the Research Committee approved the study.

Dr. M. Mukansi
Chairperson of HJH Ethic and Research Committee

Appendix G: HREC approval

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Dr V Naidoo

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220430

NAME: (Principal Investigator)	Dr V Naidoo
DEPARTMENT:	School of Clinical Medicine Department of Surgery Division of Orthopaedic Surgery Medical School University
PROJECT TITLE:	*Comparison of visual estimations of distal radius radiographic parameters between different levels of orthopaedic professionals*
DATE CONSIDERED:	2022/04/29
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Drs J Du Plessis and B Milner
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/06/09

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report.** When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **April** and therefore reports and re-certification will be due in the month of **April** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

10/06/2022
Date

Appendix H: Journal guidelines (SAOJ)

Criteria for publication

The article falls within the scope of the journal.
Methods, statistics, and other analyses are performed to a high technical standard and are described in sufficient detail.
Results reported have not been published elsewhere.
Conclusions are presented appropriately fashion and are supported by the data.
The article is presented in an intelligible fashion and is written in standard English (British usage).
The research meets all applicable ethical standards.
The article adheres to guidelines provided in the instructions for authors section.
Guidelines for authorship

Each author should participate and is responsible for the content and design of the study, the preparation of the manuscript and its revisions, and final approval.
In order to qualify for authorship, authors should satisfy all four the criteria for authorship as specified by the ICMJE:
Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
Drafting the work or revising it critically for important intellectual content; AND
Final approval of the version to be published; AND
Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
Other 'contributors' or 'collaborators' can be acknowledged at the end of the manuscript together with their contribution. Those whose contributions do not justify authorship may be acknowledged individually or together as a group under a single heading (e.g., "Clinical Investigators" or "Participating Investigators"), and their contributions should be specified (e.g., "served as scientific advisors," "critically reviewed the study proposal," "collected data," "provided and cared for study patients", "participated in writing or technical editing of the manuscript".
The South African Orthopaedic Journal accepts a maximum of 8 authors per article. If there are more than eight authors, the first eight authors must be listed along with the group name at the end. The remaining authors and their affiliations must then be listed in an appendix.
On submission of your article, the ORCID (Open Researcher and Contributor ID) identifier of at least the corresponding author will be required. ORCID provides a persistent digital identifier that distinguishes you from every other researcher and supports automated linkages between you and your professional activities, ensuring that your work is recognised. To register and find more information, please visit: http://orcid.org
Registration of clinical trials

A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Interventions include drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes.
Clinical trials should be registered in a public trials registry in accordance with International Committee of Medical Journal Editors
Trials must be registered and approved by the relevant authorities before the onset of patient enrolment.

The Medicines Control Council (MCC) reference number and the SA National Clinical Trial Register (SANCTR) registration number should be included at the end of the abstract of the article.
Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) do not require registration.
Reporting guidelines

All articles should be prepared in accordance with the guidelines relevant to the study design, as described in the Equator Network Guidelines (https://www.equator-network.org/reporting-guidelines/)
Randomised trials should be accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrolment, randomisation, withdrawal and completion, and a detailed description of the randomisation procedure.
Reporting of statistics

In terms of the statistical reporting, the Equator Network advises on the use of the SAMPL guideline: https://www.equator-network.org/2013/02/11/sampl-guidelines-for-statistical-reporting/

The SAMPL guidelines provide two guiding principles

"Describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results." When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing, such as P values, which fail to convey important information about effect size.
Provide enough detail that the results can be incorporated into other analyses. This requires reporting the descriptive statistics from which other statistics are derived, such as the numerators and denominators of percentages, especially in risk, odds, and hazards ratios. Likewise, P-values are not sufficient for re-analysis. Needed instead are descriptive statistics for the variables being compared, including sample size of the groups involved, the estimate (or effect size) associated with the P-value, and a measure of precision for the estimate, usually a 95% confidence interval.
Some specific guidelines applicable to the SAOJ:

Consistency is one of the most important factors in presenting a well-formatted, professional manuscript.
The nature of the measurements and variables reported on will often dictate the amount of precision required. Report numbers - especially measurements? with an appropriate degree of precision. For ease of comprehension and simplicity, round to a reasonable extent.
The recommendation is to report the number of decimals that have both clinical and statistical meaning and consistently reporting all other variables in the same manner.
Note: Generally, for descriptive purposes, percentages are reported as whole numbers except when dealing with really large sample sizes
At least for the primary outcomes, report a measure of precision (a confidence interval).
Although not preferred to confidence intervals, if desired, p values should be reported as equalities to three decimal places (e.g., $p = 0.031$ and not as inequalities: e.g., $p < 0.05$). Do NOT report NS; give the actual P-value. The smallest P-value that needs to be reported is $P < 0.001$.
Report numerators and denominators for all percentages

Summarize data that are approximately normally distributed with means and standard deviations (SD). Use the format: mean (SD) not mean ?
Summarize data that are not normally distributed with medians and interpercentile ranges, ranges, or both.
Do NOT use the standard error of the mean (SE) to indicate the variability of a data set. Use standard deviations, inter-percentile ranges, or ranges instead.
Formatting examples:

$p = 0.028$ or $p < 0.001$
(43% vs 21%; $p = 0.002$)
(odds ratio (OR) 0.38; 95% confidence interval (CI) 0.71 to 1.82; $p = 0.822$) or after first use (OR 1.62; 95% CI 1.41 to 1.86; $p < 0.001$)
Descriptive stats normal distribution: mean age 36 years (SD 4 years) or 36 years (SD 4; range 40 to 97 years)
Descriptive stats non-normal distribution: median age 36 years (IQR 44 to 88 years) or 36 years (IQR 44 to 88 years; range 40 to 97 years)
Descriptive stats percentage: (149 of 202; 74%)
Formatting of submissions

Text formatting

Use Helvetica or Arial font, size 11.
Use double line spacing throughout the document.
Number the pages of the blinded manuscript consecutively.
Use italics for emphasis.
When referring to an article with multiple authors, please use the following format: Rabinowitz et al. published their retrospective review.
Do not use field functions.
Use tab stops or other commands for indents, not the space bar.
Use the table function, not spreadsheets, to make tables.
Use the equation editor or MathType for equations.
Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).
Headings

Use no more than three levels of displayed headings.
Abbreviations

Define abbreviations and acronyms at first mention and use consistently thereafter.
Units

Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.
Figures

Figures should be numbered consecutively with illustration Arabic numbers 1, 2, 3, etc.
The figure should be listed in the text as follows: … wound irrigation and splinting (Figure 1).
Figures should be clear and easily understandable with a full descriptive legend stating any areas of interest and explaining any markings, letterings or notations. All figures and figure legends should be understandable as a stand-alone item, without having to read the main body of the text.

For radiographs, please ensure you state the view used and the time point at which it was taken, as well as the demographic details of the patient if applicable.
Please submit the original JPEG (300 dpi) or TIFF of all photographs, as well as the figure saved as a Word document. The Word version of the figure should be complete with the legend and any necessary markings such as letters or arrows.
Figures such as graphs and algorithms should be in Word or PowerPoint in order to be editable.
Figures should not be imbedded in the text file but should be submitted as separate individual files. Each figure should be a separate file, entitled Figure 1, Figure 2, etc.
Remove all markings, such as patient identification, from radiographs before photographing. Clinical photos must be adequately anonymised.
A statement of patient consent for clinical photographs must be provided on the title page.
In images depicting X-rays of children there should exhibit adequate shielding of radiation.
All line or original drawings must be done by a professional medical illustrator.
We accept a maximum of six figures. You may apply to the Editor-in-Chief for permission to include more figures if considered critical to the clarity and completeness of the submission.
Do not submit any figures, photos, tables, or other works that have been previously copyrighted or contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.
Tables

Tables should carry uppercase Roman numerals, I, II, III, etc.
Tables should always be cited in the text in consecutive numerical order.
The table should be identified in the text as follows: Details of results are listed in Table I. Or, alternatively,? high-energy trauma that is often associated with these fractures (Table II).
Tables should be used to present information in a clear and concise manner. All tables should be understandable without the main text.
For each table, please supply a table heading explaining the components of the table.
Identify any previously published material by giving the original source in the form of a reference at the end of the table heading.
Footnotes to tables should be indicated by superscript lower-case letters and included beneath the table body.
Please submit tables as editable text and not as images. They should be created using the Table tool in Word.
Do not embed tables in the text file but submit them as separate individual files. Each table should be a separate file, entitled Table I, Table II, etc.
We accept a maximum of eight tables.
Do not duplicate information given already in the text.
Do not submit any figures, photos, tables or other works that have been previously copyrighted or contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.
References

References should be numbered consecutively in the order that they are first mentioned in the text and listed at the end in numerical order of appearance.
Identify references in the text by Arabic numerals in superscript after punctuation.
References should not be a listing of a computerised literature search but should have been read by the authors and have pertinence to the manuscript.
Accuracy of references is the authors' responsibility, and the author is to verify the references against the original documents.

Manuscripts in preparation, unpublished data (including articles submitted but not in the press) and personal communications may not be included in the reference listing. They may be listed in the text in parentheses only if absolutely necessary to the contents and meaning of the article. The titles of journals should be abbreviated according to the style used in Index Medicus, obtainable through the website http://www.nlm.nih.govshould
The following format should be used for references:
Journal article:

Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE. Civilian gunshot injuries of the spinal cord: a systematic review of the current literature. Clin Orthop Relat Res 2013;471:3945-55.

Ideally, the names of all authors should be provided, but the usage of et al. in long author lists (more than six authors) will also be accepted: Fong K, Truong V, Foote CJ, et al. Predictors of nonunion and reoperation in patients with fractures of the tibia: an observational study. BMC Musculoskelet Disord 2013;14:103.

Online journal article:

Caetano-Lopes J, Lopes A, Rodrigues A, et al. Upregulation of inflammatory genes and downregulation of sclerostin gene expression are key elements in the early phase of fragility fracture healing. PLoS One 2011;6:e16947.

Web reference (with authors):

Cierny G, DiPasquale D. Adult osteomyelitis protocol. http://www.osteomyelitis.com/pdf/treatment_protocol.pdf.

(date last accessed 05 March 2013).

Web reference (no authors listed):

No authors listed. International commission on radiological protection. http://www.icrp.org (date last accessed 20 September 2009).

Chapter in a book:

Young W. Neurophysiology of spinal cord injury. In: Errico TJ, Bauer RD, Waugh T (eds). Spinal Trauma. 3rd ed. Philadelphia: JB Lippincott; 1991: 377-94.

Dissertation:

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

Abstract:

Peterson L. Osteochondritis of the knee treated with autologous chondrocyte transplantation [abstract]. ISAKOS Congress, 2001.

Structure and content of submission

We accept a maximum of 3 500 words, including the abstract and body of the text (excluding references).
Exceptions to this rule may be made for systematic reviews and meta-analysis at the discretion of the Editor-in-Chief.
Please follow the following structure when preparing your submission. Each of the following should be submitted as a separate file.
Title page (title, authors and affiliations, corresponding author and declarations)
Blinded manuscript (Abstract, keywords, introduction, methods, results, discussion, funding sources, conflict of interest statement, ethics statement, acknowledgements and references)
Tables (with headings), each table as a separate file.
Figures (with legends), each figure as a separate file.
Title page

Title

The title should be concise and informative.
Author names and affiliations

Please provide the following information for each author:
Full names and surname, as well as title
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Please check that all names are accurately spelled.
Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate affiliation details.
Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
Corresponding author

Clearly indicate who will handle correspondence at all stages of refereeing and publication, including post-publication.
Ensure that the e-mail address and permanent address is given and that contact details are kept up to date by the corresponding author.
Please note that the corresponding author's contact details will be provided in the final article.
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Affiliation
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Declarations

Authors are to insert a section at the end of the title page entitled declarations (please provide the author's name, signature and date). The following statements are required under the declarations section:

Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

The conception and design of the study, or acquisition of data, or analysis and interpretation of data.
The drafting of the article or its critical revision for important intellectual content.
Final approval of the version to be submitted.
Sound scientific research practice

The authors further confirm that:

The manuscript, including related data, figures and tables, has not been previously published and is not under consideration elsewhere.
No data have been fabricated or manipulated (including images) to support conclusions.
This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. 'salami-publishing').
Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

No data, text or theories by others are presented as if they were the authors' own.
Proper acknowledgements of others' work have been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
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Conflict of interest statement

A conflicting interest exists when professional judgment concerning a primary interest (such as the patient's welfare or the validity of research) may be influenced by a secondary interest (such as financial gain or personal rivalry). It represents a situation in which financial or other personal considerations from authors, reviewers or editors have the potential to compromise or bias professional judgment and objectivity. It may arise for the authors when they have a financial interest that may influence their interpretation of their results or those of others. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, grants or other funding. All potential conflicts of interest need to be declared. The conflict of interest statement should list each author separately by name, e.g.,

'Author A.B. (use initials of relevant author, not full name in order for the document to remain blinded) has received research grants from Company A. Author B.C. has received a speaker honorarium from Company X and owns stock in Company Y. Author C.D. is a member of committee Z.'

If no conflicts of interest exist, state this as follows:

'The authors declare they have no conflicts of interest that are directly or indirectly related to the research.'

Funding sources

All sources of funding should be declared. Also, define the involvement of study sponsors in the study design, collection, analysis and interpretation of data; the writing of the manuscript; and the decision to submit the manuscript for publication.

List all funding sources as follows:

‘This work was supported by the xxxx (grant numbers xxxx, yyyy).’

When funding is from a block grant or other resources available to a university, college or other research institution, submit the name of the institute or organisation that provided the funding.

If no funding was received, state as follows:

‘No funding was received for this study.’

Compliance with ethical guidelines

For all publications:
‘The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.’

Available from: http://publicationethics.org/resources/international-standards-for-editors-and-authors

Institutional Review Board (IRB) ethical approval must have been given if the study involves human subjects or animals. Please provide the approval number. IRB documentation should be available upon request.

‘Prior to the commencement of the study ethical approval was obtained from the following ethical review board: Provide name and reference number’

For studies with human subjects include the following:
‘All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.’

‘Informed written consent was or was not obtained from all patients for being included in the study.’

‘Consent was obtained from patients for the use of clinical photographs and these images were adequately anonymised.'

For studies with animals, include the following sentence:
‘All institutional and national guidelines for the care and use of laboratory animals were followed.’

For articles that do not contain studies with human or animal subjects:
‘This article does not contain any studies with human or animal subjects.’

If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. If any identifying information about patients is included in the article, the following sentence should also be included: Additional informed consent was obtained from all patients for which identifying information is included in this article. The Helsinki Declaration 2008 can be found at http://www.wma.net/en/30publications/10policies/b3/
Please provide the names and email addresses of two reviewers.

Title Page Example

Title of Submission

John Smith*

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University of South Africa, 123 High Street, Pretoria

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Declarations:

Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

The conception and design of the study, or acquisition of data, or analysis and interpretation of data.

The drafting of the article or its critical revision for important intellectual content.
Final approval of the version to be submitted.
Sound scientific research practice

The authors further confirm that:

The manuscript, including related data, figures and tables, has not been previously published and is not under consideration elsewhere.
No data have been fabricated or manipulated (including images) to support conclusions.
This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. 'salami-publishing').
Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

No data, text or theories by others are presented as if they were the authors' own.
Proper acknowledgements of others' work have been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
Permissions have been secured for copyrighteed material.
Conflict of interest statement

John Smith declares that he has no conflict of interest. Paula Taylor has received research grants from Drug Company A.

Funding sources

No funding was received for the purposes of performing this study.

Compliance with ethical guidelines

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.

Prior to the commencement of the study ethical approval was obtained from the following ethical review board: Provide name and reference number.

All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Informed written consent was or was not obtained from all patients for being included in the study.

Consent were obtained from patients for the use of clinical photographs/ and these images were adequately anonymised.

Author Name

Signature

Date

J Smith

15/8/2017

P Taylor

16/8/2017

Blinded manuscript

To ensure a blinded review, the main body of the manuscript should not contain any identifying information, including author's names, institutions or affiliations. Please do not include the name of the ethics committee, this information should be provided in the title page.

Abstract

A structured abstract (maximum of 350 words) summarising the most important points in the article is required.
The abstract consists of four paragraphs with the subheadings:
Background (must include the aim of the study)
Patients and methods
Results
Conclusion
References should be avoided. Avoid uncommon abbreviations. If essential, they must be defined at their first mention in the abstract itself.
Keywords

Immediately after the abstract, provide a maximum of six keywords using standard searchable terms. These keywords will be used for indexing purposes.
Level of evidence

Level 1 to 5.
Please follow the level of evidence guidelines provided by the Oxford Centre for Evidence-Based Medicine (OCEBM); version 2.1.
Available from: OCEBM Levels of Evidence Working Group. 'The Oxford Levels of Evidence 2'.Oxford Centre for Evidence-Based Medicine. http://www.cebm.net/index.aspx?o=5653
Introduction

The introduction should contextualise the study by providing the background to the research; explain the problem that is to be addressed, and provide the rationale for the study.

Briefly outline the relevance of the study with respect to the current literature. Avoid a detailed literature survey or a summary of the results.
The last sentence should outline the research question or hypothesis.
Patients (or Materials) and methods

State the methods, outcome measures, and selection criteria. The following aspects need to be described:
The study design and research methodology
Whether randomisation (with methods) was applied
If case-controlled, how the controls were selected
The time period under review
Number of patients/subjects under investigation and why this number was chosen
Inclusion and exclusion criteria
Case and outcome definitions
A description of the procedure or intervention, including post-operative protocol
The outcome measures or scores used
The minimum follow-up period
Statistical analysis paragraph. This should be included at the end of this section to detail statistical tests and package used, the reasons why these tests were used, and what p-value was considered statistically significant. A power analysis is recommended for studies comparing two or more groups.
Provide sufficient detail so that another researcher can replicate the study.
The reader should understand from this description all potential sources of bias such as referral, diagnosis, exclusion, recall or treatment bias. This includes the manner in which investigators selected the patients. Consecutive inclusion implies all patients with a given diagnosis are included, while selective implies patients with a given diagnosis but selected according to certain explicit criteria (e.g., state of disease, choice of treatment).
Do not describe standard procedures for common operations. Only include new procedures or adaptations to standard procedures.
If you name any specific product, it requires the manufacturer's name, city and state/country.
Present information in the narrative format and use the past tense.
Where relevant, tables or figures may be included to provide information more clearly.
Generally, no data should be presented in this section.
Results

Describe the relevant results and analysis thereof.
Provide details of the number of patients included and excluded, as well as the reason for exclusion.
It is important to state the follow-up period (mean and range).
The results can be broken down into separate sections, e.g. Treatment, Functional outcome, Complications, etc.
Tables may be used but avoid repeating data reported in the text in the tables.
All appropriate data should be presented as means with ranges, not with standard deviations (SDs). Medians should only be used when the data is skewed, accompanied by an interquartile range (IQR).
Avoid using percentages in studies involving well under 100 subjects.
All results must be backed up with p-values or survivorship analysis. All Kaplan-Meier data should be presented with confidence intervals. Always present exact absolute p-values, whether significant or not, unless $p<0.001$.

However, P-values do not always convey the entire picture and where relevant, the confidence interval will also be required (in addition to the power of the study reported in the methods section).

Discussion

The question or hypothesis stated at the end of the introduction should be discussed and either supported or rejected.

The results must be interpreted clearly, and any deficiencies expressed. All possible confounding factors, sources of bias or weaknesses in the study should be identified.

Explore the significance of the results of the work rather than repeating the results.

The discussion must point out the relevance of the work described in the paper and its contribution to current knowledge.

Explain what can be deduced from the results and how will it affect clinical practice.

Include a review of the relevant literature, placing the results of the study in the context of previous work in this area.

Discussion of relevant prior research and references must be concise. Avoid extensive citations and discussion of published literature emphasize previous findings that agree (or disagree) with those of the present study.

Do not repeat the introduction.

Present the limitations of the study and suggest how the study could have been improved for a future study.

Avoid making inferences from non-significant trends unless you believe your study is adequately powered to answer the question; in that case, provide a power analysis.

Conclusion

Provide a summary statement that conveys the conclusions of the findings.

Do not draw conclusions not supported by the data obtained from the specific study presented.

Ethics statement

For studies involving human subjects, please include an ethics statement as follows: ‘All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.’

For animal studies, please include the following ethical statement: ‘All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.’

If the study did not involve human or animal subjects, state that: ‘This article does not contain any studies with human participants or animals performed by any of the authors.’

Please also include an informed consent statement: ‘Informed consent was obtained from all individual participants included in the study.’

Alternatively, for retrospective studies, please add the following sentence: ‘For this study formal consent was not required.’

If identifying information about participants is available in the article, the following statement should be included: ‘Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.’

Acknowledgements

Acknowledgements should be placed at the end of the discussion and before the references.

In this section, persons who were involved but did not earn authorship can be acknowledged.

Statements should be brief. A person can be thanked for assistance or comments.

Do not include contributions by editors or referees.

Author contributions

Please state the contributions of each author
For example: ‘A.B contributed to the study conceptualisation, design, data analysis and manuscript preparation. C.D. contributed to data collection and manuscript preparation. E.F. contributed to ....’
The types of contributions are:
Conceptualisation and design
Data collection or contribution
Data analysis
Manuscript preparation
Other contributions (please specify)
References

Please refer to the section on Formatting of submissions.
Tables and figures

Tables and figures should not be imbedded in the text file but should be submitted as separate individual files. Each table should be a separate file, entitled Table I, Figure 2, etc.
Each table and figure should be provided with a heading or legend.
Please refer to the ‘Formatting of submission’ section for further guidelines.
Case reports

In addition to the preceding guidelines the following applies:

The following headings need to be adhered to in the body of the manuscript:
Abstract
Keywords
Background
Case report
Discussion
Conclusion
Ethics statement
References
Abstract: Minimum 250 words (350 maximum), using the following headings:
Background
Case report
Discussion
Conclusion
Statement of informed consent must be included in the ethics statement.
Current Concepts Review Article (by invitation only)

General Guidelines:

A narrative review will suffice (and systematic or scoping review not necessary)
A thorough literature review needs to be done prior to writing the manuscript to ensure that the author is well acquainted with the current concepts related to the topic (with emphasis on the most recent developments)
A balanced and unbiased view of the current clinical aspects of the topic.
Focus on clinical aspects like diagnosis and treatment.
Discuss controversies and state both sides of the argument.

Avoid extensive discussion of basic science (anatomy/physiology/pathology) aspects, except for some really novel and clinically relevant new developments in the field.
The topic may be adapted, but only with the permission of the Editor-in-Chief.
Outline of Article:

Abstract = One paragraph, no headings, ≤350 words.
Introduction = Brief introduction to the topic
Contents = Please use headings (in bold) and sub-headings (in italics) to structure the manuscript in a reader-friendly manner
South African context = Discuss matters which may be particularly relevant or unique to the South African clinical setting.
Learning points = Make use of tables to summarize important learning points
Conclusion = Brief evidence-based conclusion and summary
Conflict of interest statement
References = As usual

Appendix I: Student's contribution the research and writing of the "submissible" paper (form)

Division of Orthopaedic Surgery

Faculty of Health Sciences, 4M Room 12, Wits Medical School, 7 York Road, Parktown 2193

• Tel: +27 11 717-2538 e Fax: +27 11 717-2551

Xx May 2023

Faculty of Health Sciences, University of the Witwatersrand

RE: VISHAD NAIDOO'S CONTRIBUTION TO THE RESEARCH AND WRITING OF THE "SUBMISSIBLE" PAPER

To whom it may concern,

This letter serves to confirm that the co-authors of the " submissible" research paper have agreed to its use by Vishad Naidoo student number: 0701303A as part of his MMed research report. Vishad Naidoo made a substantial contribution to conducting the research study and writing the manuscript.

Yours Sincerely,

Jason du Plessis
Primary Supervisor

Vishad Naidoo
MMed Candidate