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Contents

Foreword

Welcome to the latest edition of the International Journal of Clinical Skills (IJOCs), Volume 7, Issue 5, September 2013.

Self-assessment is an essential component of the lifelong learning expected of physicians. There are limited data on the relationship between medical students' self-assessments and their self-directed learning goals. Researchers at The Warren Alpert Medical School of Brown University, Massachusetts General Hospital and MAHEC Family Medicine Residence Program, USA, present some interesting findings when evaluating medical students' self-assessment of both clinical and professional competencies as well as self-directed learning goals.

Empathy is a key attribute for providing quality health care, lying at the heart of patient-doctor relationships and many medical schools employ Peer Physical Examination (PPE) to improve empathy and clinical skills. However, student empathy often declines over the medical course. Academics at James Cook University, Australia, evaluate participation in PPE and its impact on both students' clinical skills and empathy levels. The results of this study have implications for medical school policy makers.

The skill of hand-tying knots in open surgery is typically passed down from residents to medical students early in training – there is no formal education and thus incorrect assumptions about knots are often perpetuated. While achieving absolute maximal knot security may not matter clinically with routine wound closures, it can be important in other situations. Dr David Flanigan and Dr Vincent Ng at The Ohio State University, USA, discuss the proper methods for tying basic surgical knots - an essential article for all medical schools and trainees.

As always, your feedback is invaluable for the continued development of the International Journal of Clinical Skills – the only peer reviewed international journal devoted to clinical skills (e-mail: feedback@ijocs.org)

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Hand-tying knots in open surgery is an easily overlooked fundamental

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Keywords

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Abstract

The skill of hand-tying knots in open surgery is typically passed down from residents to medical students early in training. A misconception among junior trainees and physician extenders, is that simply alternating overhand and underhand throws essentially “locks” a knot or creates a square knot. We illustrate the proper methods for tying basic surgical knots.

Introduction

The skill of hand-tying knots in open surgery is typically passed down from residents to medical students early in training. Learning the mechanics of one-handed and two-handed ties is not overly complex, but because there is no formal education, incorrect assumptions about knots are often perpetuated. One such misconception, particularly amongst junior trainees and physician extenders, is that simply alternating overhand and underhand throws essentially “locks” a knot or creates a square knot. While achieving absolute maximal knot security may not matter clinically with routine wound closure, it can be important in other situations.

Techniques

The first step in hand-tying knots is clarifying what a square knot should look like (Figure 1). Notice the subtle difference between the square knot and the granny knot (Figure 2). In order to throw a square knot, different direction throws (overhand-underhand or vice versa) should be used, and for a granny knot, same direction throws are used. The security of a square knot is greater than a granny knot. In both types, the knot should lie flat. Symmetric knot construction can decrease suture extrusion [1]. In order to avoid twisting of the knot and to allow the limbs to exit on the same side as their corresponding loop, the surgeon's hands need to overlap correctly at some point during knot tying. If the loops are crossed initially before the first throw (Figure 3A, B), the surgeon's hands simply need to overlap once when tightening the second throw (Figure 3C). If the limbs do not exit on the same side as the corresponding loop, then the square or granny knot does not lie flat.

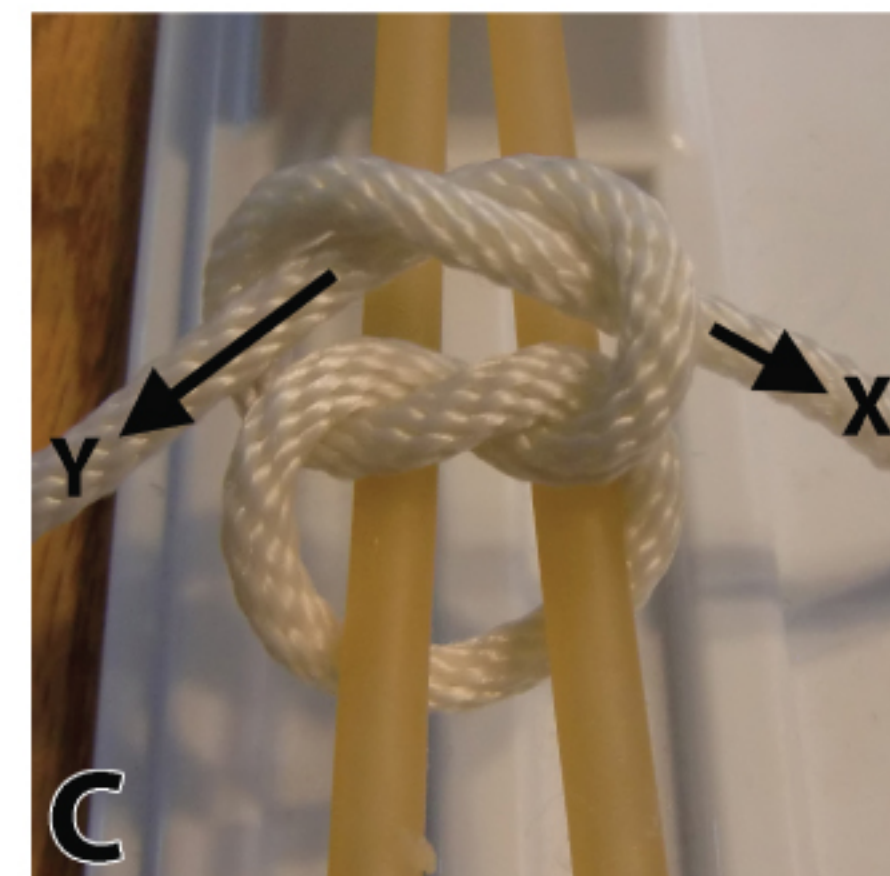
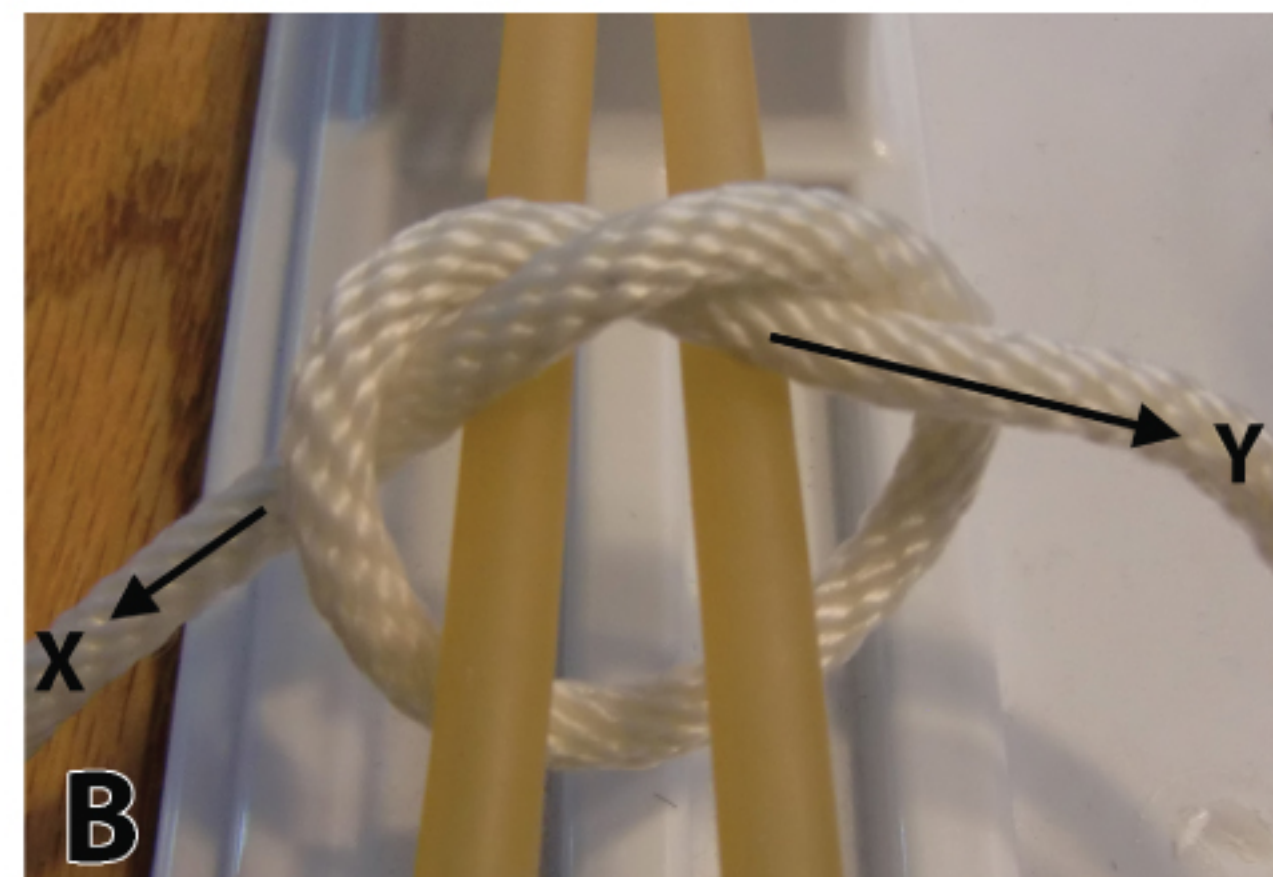
Figure 1: Square knot. Note how the knot lies flat



Figure 2: Granny knot. Note how the knot lies flat



Figure 3: (A) Start with the limbs crossed. Limbs are labelled X and Y. (B) The first throw will lie flat without needing to overlap hands. (C) In order for the second throw to lie flat, the surgeon's hands overlap to tighten the knot



A surgeon's knot refers to an initial double-wrapped throw followed by a single-wrapped throw. This is to improve loop security such that the first throw does not loosen through the tissue while the second throw is being tightened. A granny- or square-style (Figure 4) knot can be used with the surgeon's knot. A common mistake with any knot is the application of an excessive number of additional throws. Once a well-tied knot is secure, more throws do not provide additional benefit because the knot will fail not by slippage but by breakage.

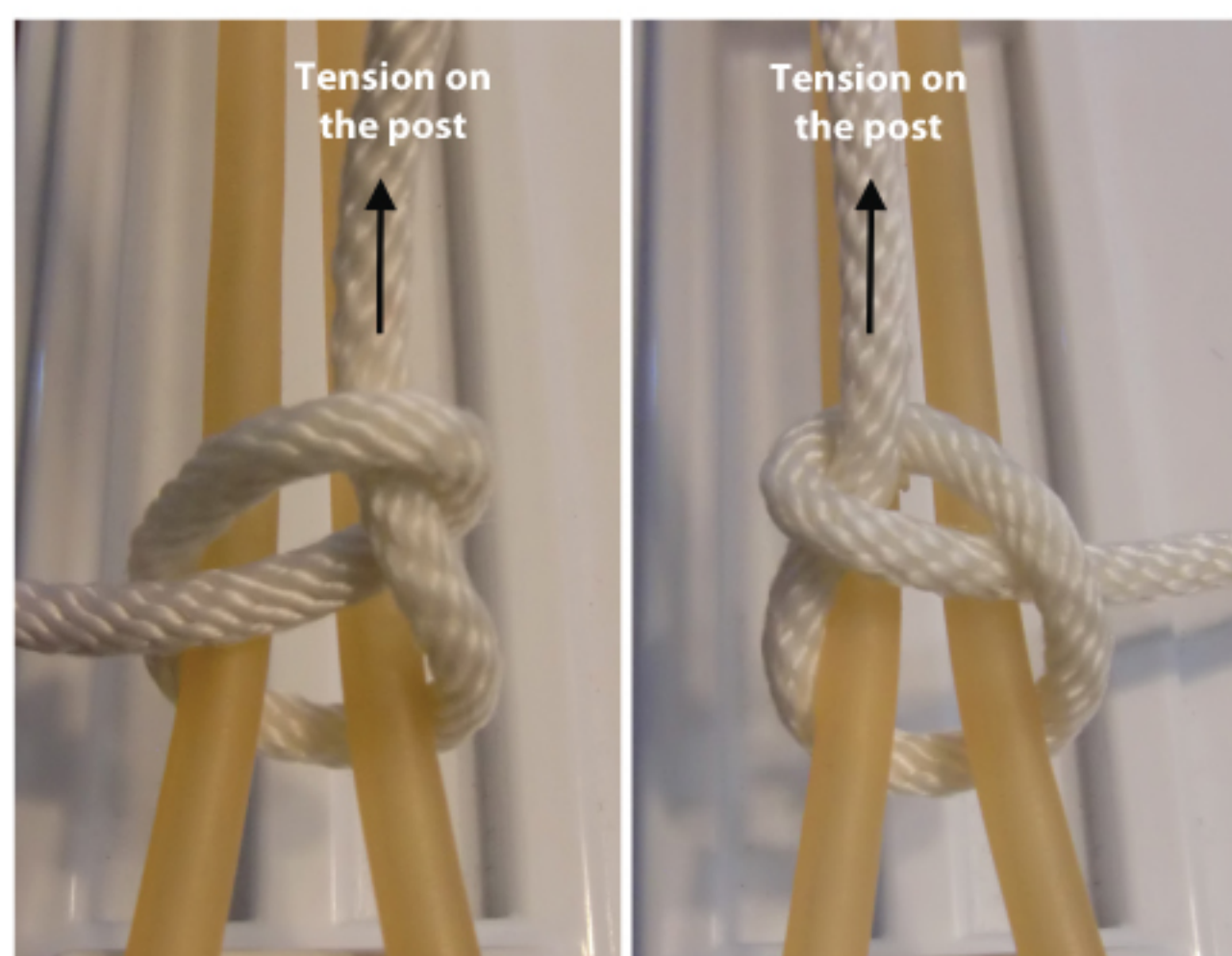
Figure 4: Surgeon's knot. The double-wrapped throw is to prevent slippage of the loop during tightening of the knot



A slip or sliding knot refers to a knot that is tied upon a post. A post is when one suture limb is held with tension and the other limb is used to tie the knots. Sliding knots are particularly useful when deep tissue is being approximated so that the knot needs to be thrown outside of the body and then slid down to the level of the tissues. Past-pointing is necessary to fully tighten a sliding knot. The force necessary to slide a granny or square knot down to the tissue may exceed the knot breakage strength and cause the suture to break at the knot. Because of this, with square or granny knots, if the first throw loosens while the second throw is being tightened, a so-called air knot that cannot be slid fully down to the tissue may result.

When tightening any knot, the force applied to the suture limbs should be steady and not in a jerky fashion which increases the shear forces within the knot and can cause breakage. When tightening square and granny knots, the limbs should be pulled with equal tension. If unequal tension is applied, it is very easy to inadvertently convert one limb into a post and create a sliding knot [2]. If desired, the post can actually be flipped to the other limb by switching tension to the other limb without re-throwing the knot (Figure 5).

Figure 5: Slip knot. Note that by changing the limb that is tensioned (A to B) essentially flips the post to the other limb



Overhand or underhand throws stacked on a post are called half-hitches. Knot security for sliding knots is lower than for square or granny knots [3]. Sliding knots are useful because they can slip down a post, but by the same token, they can slip off the post after the knot has been tied. To improve knot security, alternating posts and reversing direction half-hitches should be used [4] (Figure 6). This avoids stacking all the half-hitches on the same post. In open surgery, sliding knots can be also secured by performing flat knots behind them that do not slide.

Figure 6: A base knot of identical half-hitches stacked on a post (*) followed by three reversing half-hitches on alternating posts (#)



Conclusion

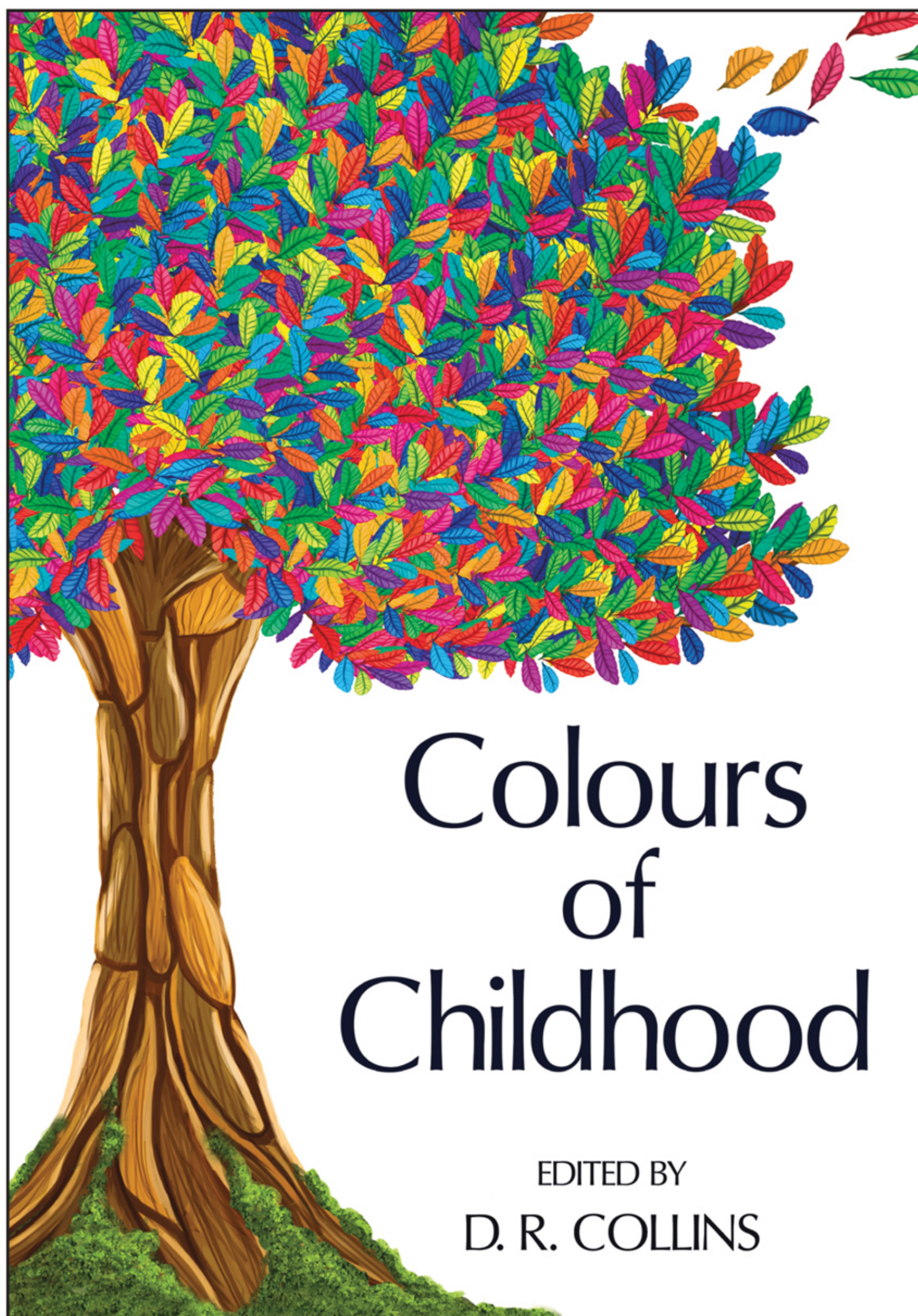
In summary, square knots are more secure than granny knots and both are more secure than sliding knots. Both limbs of non-sliding knots should be tensioned equally to avoid inadvertent conversion to a sliding knot. Sliding knots can be used to progressively tighten tissue, to approximate deep tissue layers, and to avoid air knots. However, to avoid slippage of sliding knots, they should be backed by reversing half-hitches and alternating posts or be followed by a series of non-sliding square knots.

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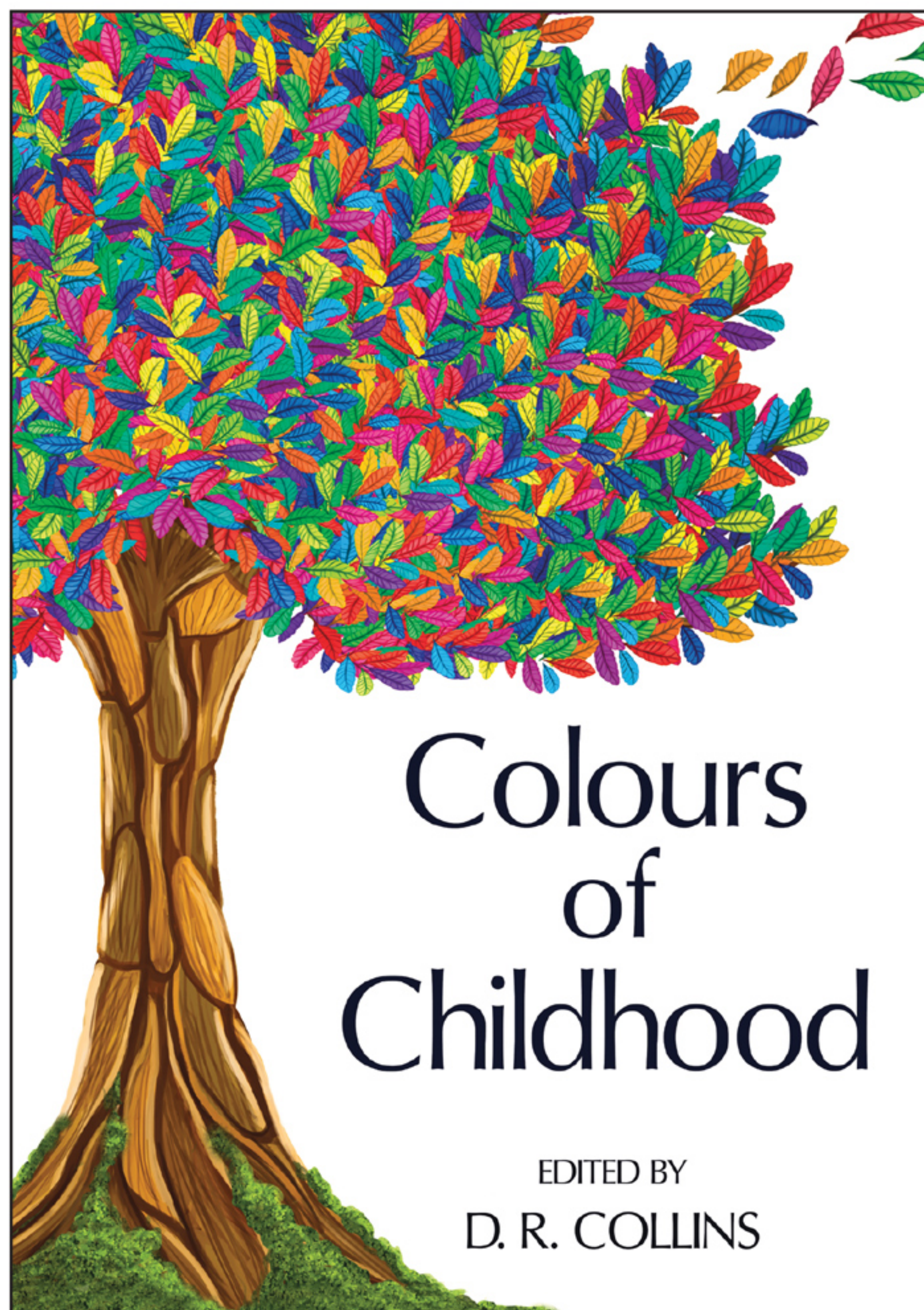
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