STUDY ON NAIL LESS WOODEN JOINTS
INDERJIT KAUR BAL
Department of Architecture and Design, Faculty of Architecture
Lovely Professional University, Phagwara.

MANISH KHANNA
Research scholar, Department of civil engineering
NIT, Jalandhar

Abstract:
In recent trends most of the industries are working on how to reduce the joints in Furniture design. Being so vast and having great scope for future innovations and trends in it the researchers from interior design, furniture design, carpentry design, Architects, industrialist are looking forward for some easy concepts of reducing the usage of nails in wooden joints so that to enhance safety, aesthetics and stability of the structural model. In our study we came across various concepts and ideas which we had discussed here. This paper will focus on recent trends vs conventional trends of wooden joints and had led to various conclusions which are useful for future.

Keywords: wooden joints, nail less designs, conventional methods, new innovations.

1. Introduction
Wooden joints is always a question mark when we are going to design a new furniture an Interior designer. In early 19th century, new innovations and techniques were came in practice which led to a revolution in wooden industry. The nail less joint act as a benchmark in Interior furniture design which changed the conceptualization, design thinking, visual outlook and much more of furniture. Joints play an extempore in structural behavior of old timber frames [1]. The available research had shown that most of the interior designers are still focusing on dowel technique, though having other better options to go with some minor exceptions [2]. Dowel type of connections are becoming the hot favorite for most scholars. Old carpentry is not able to provide the proper study and also in bifurcating that what should be adopted and what not to. This discussion is to provide new ideas and how tom apply available methods in a proper way to get our desires fulfilled [5], [6], [7]. There are many theories which are helping us to get an idea that how to utilize a technique but still due to lack of better resources some lack in applicability,[8]. Our research is focused to provide a generalized study on recent trends and easy methods for furniture outlook in a better way.

2. Methods
There are several methods available to join a joint, we had studied the benefits & shortcomings of various joints and conventional techniques used by various researchers.
Methods are as given below:-

2.1. Conventional nail joints
These joints are the most common types of joints which are used by any furniture designer.
Nails are used in almost every kind of materials, in fig. 1 we had tried to show you the shortcoming of nails, enumerated as rusting, improper fixing, unsafe etc. Nail joint have benefits like shear resistance, load bearing, joint strength [13], but as an interior designer these benefits are not able to meet any Aesthetics and safety concerns which is an important factor. Kei Sawata had studied the shear capacity and bond strength in 2012 and had concluded that edge distance, nail specifications, nail positions played an important role in studying parameters but said that alternate joints can be a better option [13].

![Figure 1: Nail joint on wood](image)

We had studied more than 50 types of Nail less joints which are not only good in strength and shear Resistance but have aesthetics and safety concerns covered as well. Out of which the best we found are:-

### 2.2. Mortise-and-Tenon

In previous research most of the researchers used one of the most promising method for nail less joint, widely used in accepted by many designers all across world. It is an old school technique, consists of one square or rectangular shape part which act as a binder to fill the gap which is intentionally made in Mortise, so that to make the joint a complete periphery leading to high strength [9], the joint is shown as in fig. 2 Weng gang et la had given numerical methods, mathematical model, structure design which were were of great help for the researchers to evaluate parameters like bond strength, shear, optimization of design and providing useful simulation analysis [10]. A minimum number of joints can lead to greater amount of strength which is a key for designer, so reducing joint is of great importance, the tenon & mortise is capable for doing it [8]. Mortise and tenon designing technique is one of the best nail less technique for interior designers that was the main reason of its success and maximum usability in market and by the team of researchers all over the world [12].
2.3. Sliding Dovetail

Most of the designers haven’t studied on this but this is one of the best and fast method as per my study. Till today no researcher had done any simulation analysis, testing, aesthetics check on this, in our research we studied about various benefits of this technique than others. Firstly we are explaining what this joint method is under this, Dovetail as shown in fig.3 uses a sliding mechanism which can be easily dissembled anytime, anywhere, due to no restrictions of glues or pins at ends this joint become so flexible that it is easy to remove the joint. This method is very suitable in making furniture at ground level at one end can be restricted by floor thus making it stable. Once you had assembled the whole assembly this joint have maximum strength than the other joints.
2.4. Doweling

Doweling as the name suggests 2-3 pins are used and act as male joint which are inserted in female joint leading to complete the mechanism. One of the oldest technique based on simple theories. [9]. It is essentially a butt joint with hidden dowels that reinforce the joint. Glue is the binding agent and dowel act as catalyst for it. Making a dowel joint is a lengthy process and require great skills but is very handy in long term durability. A normal dowel joint is as shown in fig.4.

![Dowelling](image)

Figure 4: Dowelling

2.5. Biscuit (Plate) Joinery

This technique is one of the best technique for cabin designs or box designs the similar way which are used in car box design, the biscuit helps to lock the things through a common medium and thus become so good in Aesthetics. It is glued from both sides and thus increasing the stability and bond strength.[9] Once the biscuit expands with the moisture from the glue and then dries, the joint is secure. Making needs a biscuit joiner, the best thing about this technique is that it does not require any costly tool set, which makes it one of the favorite method for wood carpenters as shown in fig.5 [14].

![Biscuit Joint](image)

**Fig. 5**

**Edge-to-edge biscuit joinery**

Figure 5: Biscuit Joint
Figure 6: Different types of wooden joints
3. Results and discussions

After detailed study we came across many outcomes and benefits which are mentioned in the given table 1 below:

Table 1. Comparative results of different types of joints

<table>
<thead>
<tr>
<th>Name of joint</th>
<th>ADVANTAGES</th>
<th>DISAVDANTAGES</th>
<th>RECOMMENDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nail Joint</td>
<td>Easy to use, high strength, fast, shear resistant</td>
<td>Unsafe, no aesthetic appearance, rusting</td>
<td>NO</td>
</tr>
<tr>
<td>Mortice &amp; Tenon</td>
<td>Easy, no final joint display, Good strength, widely used</td>
<td>require great skill, time consuming</td>
<td>Yes</td>
</tr>
<tr>
<td>Sliding Dovetail</td>
<td>No joints, Easy to remove, detachable, Aesthetically good</td>
<td>Costly, require great skill, No support on one side,</td>
<td>Yes</td>
</tr>
<tr>
<td>Dowelling</td>
<td>No Surface joints, Easy to remove, detachable, Aesthetically good</td>
<td>Costly, require great skill, No support on one side,</td>
<td>Yes</td>
</tr>
<tr>
<td>Biscuit Joint</td>
<td>Aesthetically good</td>
<td>Costly, require great skill, No support on one side, time consuming</td>
<td>NO</td>
</tr>
</tbody>
</table>

4. Conclusions

The study leads to many useful conclusions for researchers and interior designers so that they can choose a better method for designing:-

1. The mortise & tenon joint method is not the one solution for advanced design, there are several other methods which can be brought into practice.
2. The conventional nail method need to be eliminated so that a proper methodology can be set as a trend
and aesthetics can be maintained.
3. Strength and shear resistance is not the key we need other parameters to be covered.
4. Nail method is risky.
5. Researchers haven’t focused on other methods i.e. biscuit, sliding rail, dowelling so this study can help them for future scopes of such techniques.
6. Interior designing and furniture modelling is an art so the list mentioned in fig.6 is of great use.

References


[12] Kei Sawata • Yosuke Shigemoto • Takuro Hirai • Akio Koizumi • Yoshihisa Sasaki, Shear resistance and failure modes of nailed joints loaded perpendicular to the grain, 20 December 2012 The Japan Wood Research Society 2012