

## TENNIS GEAR

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**Abstract.** Tennis equipment is one of the most important aspects of the game of tennis. Often, tennis equipment has a massive impact on how a tennis match plays out, or how the style of play evolves, even if it's less visible. Among the essential components of tennis equipment are the tennis balls and rackets. Complementing these elements is the playing surface, a critical determinant in the game of tennis.

This paper aims to demonstrate the evolution of tennis equipment in the importance of quality tennis history over time and how advanced technology has or has not influenced the style of play and its speed. The discernible evolution of tennis balls, encompassing variations in size and materials, has significantly shaped the sport. Similarly, the modernization of racket design and strings, incorporating diverse materials—synthetic or natural—has ushered in a new era of heightened intensity in tennis, characterized by increased speed and power.

In the same context, another key element is the playing surface, more precisely the four main surfaces, hard (or cement), clay, grass and carpet, which contributed to changing the game of tennis and its speed, stimulated by the importance of the materials used to create, or the way of maintenance of these surfaces.

Finally, in this paper, we will see how tennis modernization had a great impact on the production of tennis balls and the evolution of the way rackets are made, to which is added the composition of materials used in the creation or maintenance of playing surfaces, have led to a marked transformation of the tennis game. It will also elucidate how these changes have often elicited both acclaim and discontent among professional tennis players and, in certain instances, contributed to injuries.

**Key words:** tennis, tennis balls, rackets, tennis surfaces, evolution.

### Introduction

One of the most crucial components of the game of tennis is the equipment. Even though it's less obvious, tennis equipment has a significant influence on how a match unfolds or how the style of play changes. Tennis balls and rackets are two of the most important parts of a tennis set. The playing surface, which is an important factor in tennis, complements these components.

### Tennis Balls

Tennis balls are indeed a crucial component of the game. They are small, yellow, and typically covered in a fuzzy felt material with a white, curvilinear shape on the surface. Due to the change in the materials they are made of, balls have had a major impact on the game and its speed. Although tennis balls are very popular, their production process is less well known. The production of tennis balls follows six steps, namely:



1. **Choosing the Rubber:** Firstly, the process of creating tennis balls begins with the mixing of rubber with up to 10 additional substances until the blend is perfect.
2. **The Forming of the Half-Shells:** In the second step, the rubber pellets that cover the rubber are moulded at 155°C and machine-pressed at 160kg/cm<sup>2</sup> into half-spheres with adhesive added to the edges.
3. **The Connection of the Half-Shells:** Thirdly, in the process of manufacturing tennis balls, there is a crucial step known as vulcanisation. Before joining the components, pressurized air is added to form the core. This helps the core to conform to the correct pressure as determined by the ITF(International Tennis Federation).
4. **The Sanding of the Ball:** The next process involves placing the cores in a massive rotating drum that's been lined with sandpaper. This action is taken to rough up the surfaces of the cores. Afterward, the balls are coated with glue, making them ready for the furry covering.
5. **The Covering of the Ball:** Manufacturers use different blends of materials to create individual felt, but it is common for it to be made up of approximately one-third nylon and two-thirds wool. The reason for this is that wool has superior shape retention properties compared to nylon. To create the felt, it is first cut into specific shapes, such as 'dog bones', and then coated with adhesive.
6. **The Final Touches:** In the last step, the balls are passed through a machine to eliminate any air bubbles between the core and the material. They are then quality-controlled for factors such as size, weight, bounce height, and pressure. Finally, they are printed with the manufacturer's logo and packed into pressurized cans for use.

## History of Tennis Balls

The tennis ball has undergone several transformations over the years. Initially, it was made of wood, but later on, leather with sawdust became the preferred material. As time went by, wool replaced sawdust as the primary stuffing material, and twine was used to wrap the core. Today, the modern tennis ball that we know is a result of these evolutionary changes.

The production of tennis balls came to a halt in 1941 due to the rubber priorities of World War II. Manufacturers had to find alternative materials to crude rubber to keep the game going. It was then that Wilson came up with "Victory" ball, a synthetic rubber-based ball that was a perfect replacement for traditional tennis balls.



Source: reddit.com



Source:coachweb.com

## Tennis Rackets

Tennis rackets are one of the most essential parts of the game. Tennis rackets have seen a vast evolution in both size and shape throughout history. Tennis rackets have also had a notable impact

on the game due to the material change they are made of. The tennis racket is composed of several elements, which have an essential impact on the game, but also on the playing style of each player.

The other elements of the racket largely depend on the preferences of each player, and are related to the size of the racket, its weight, but also its length. The ITF has a number of rules and restrictions regarding the dimensions of tennis rackets that are allowed to be used in regulated matches such as: *to have a total length no greater than 29 inches (73.66cm), to be no wider than 12.5 inches (31.75cm), to have a "hitting surface" (strings) that is no more than 15.5 inches long (39.37c) & 11.5 inches wide (29.21cm)*, (ITF, 2024).

One of the key elements of the racket is its strings. There are several types of strings that have different qualities, mainly due to the materials from which they are produced. One of the most popular types of strings is synthetic gut, which is made of nylon and is ideal for beginners. Another is the multi-filament one, created from hundreds of small fibres joined together, this type of string having an ideal tension during hitting. Other type of string is the natural gut, produced from cow intestines, being used by most of the professional players because of the comfort it offers. Another common type of string is the polyester one. This type of string is much more durable and offers the possibility of shots with a lot of spin and control.

### The Evolution of the Racket

The origins of lawn tennis can be traced back to London in 1874 when Major Walter Clopton Wingfield created the first-ever tennis racket. This racket was made of solid wood with a leather grip.

In 1947, tennis rackets took a new turn with the use of laminated wood, a material that made the rackets more flexible. Brands like Slazenger, Dunlop, and Wilson capitalized on this advancement by adding paint and decals to their products, making them more unique and recognizable.

As time passed, tennis brands started incorporating graphite into the manufacturing process of their rackets in the late 1970s and early 1980s. This development led to the creation of more stable and responsive rackets, a significant improvement over the previous metal rackets.



Source: sportstechbiz.com

Currently, most tennis rackets are made of a combination of materials such as carbon fibre or fiberglass, metals like titanium alloys, or ceramics.

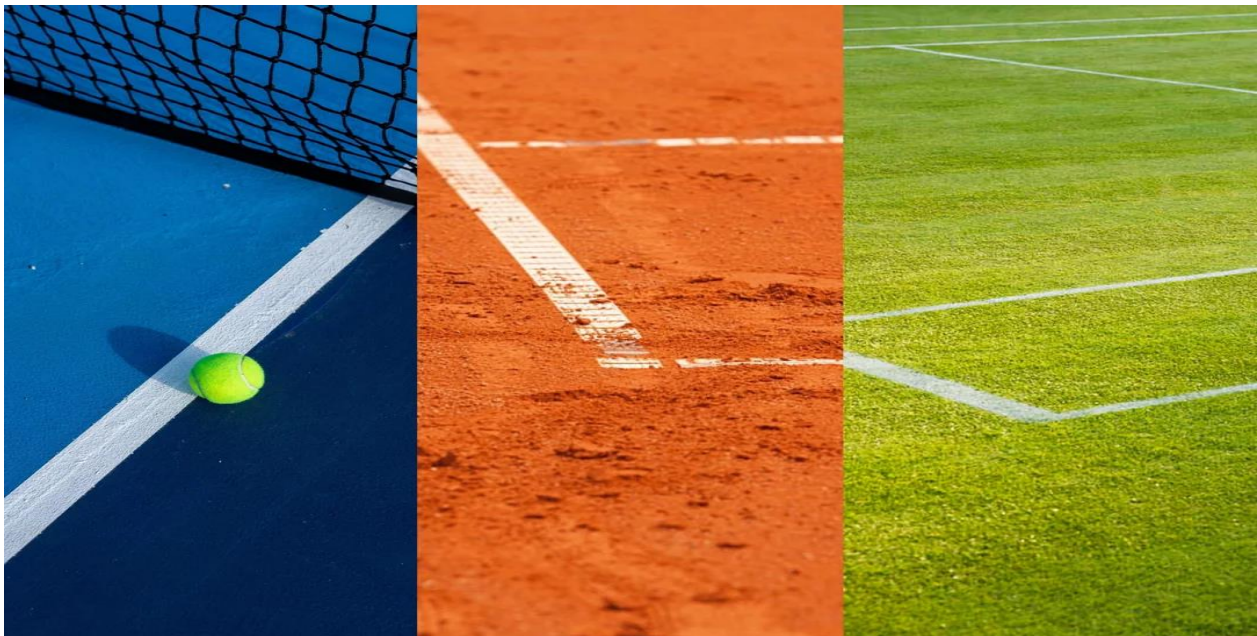
## Surfaces in Tennis

Tennis surfaces are one of the most essential aspects of the game because of how they influence a match. There are many types of tennis surfaces, but the three important ones used at the professional level are hard (cement), clay and grass. In addition to those already mentioned, there are other types such as acrylic, asphalt, carpet, concrete, artificial clay, hybrid clay, artificial grass, wood, or tiles, etc.

Hard courts consist of various mixtures of concrete and asphalt materials, which are then coated with an acrylic surface layer to provide surface sealing and cushioning. Compared to clay courts, hard courts have less energy absorption, which leads to a higher bounce and faster ball speed. There are different types of hard courts available such as DecoTurf, GreenSet, Laykold, Plexicushion, Rebound Ace, and many more.

Clay tennis courts consist of a top layer of finely crushed aggregate and can be made from materials such as stone, brick, slate or other unbonded materials. Underneath the top layer is usually a thicker layer of the same material, but compacted. Clay courts are considered "slow" due to the ball's lower bounce and speed when it makes contact with the ground, making it more difficult for players to hit shots that cannot be returned.

Grass tennis courts consist of a layer of clay, silt, and sand with a natural lawn on top. You will need a drain pipe to prevent standing water. The ball slides across the grass, making the game faster and chipping more efficient. Flat hitters, tall servers and elite volley players excel on grass.



Source: reddit.com

## Impact over tennis players

### Ball problems

Due to the constant changes in ball sizes, but also the development of technology has led to the appearance of dissatisfaction on the part of many tennis players. The periodic change of balls led to a lack of consistency and therefore to the increasingly frequent occurrence of injuries. Many professional players have accused major problems due to the constant changes made to the balls, including Daniil Medvedev or Vasek Pospisil.



## Racket problems

The most common racket-related injury is a condition called tennis elbow. To minimize the amount of shock and vibration that the arm experiences while playing tennis, it is important to consider the location of ball impacts on the racket head, the stiffness of the racket, and the force applied by the grip.

## Surface problems

Playing surfaces can often cause problems for players. Whether it's dirt or grass, these two surfaces are prone to frequent slips that can end in serious injuries. In the case of hardcourts, it has a different impact, but is equally dangerous due to the need for more force when braking on cement, which can lead to knee sprains or tears, ankle sprains, lower back, etc.

## Conclusion

Tennis equipment is one of the most essential parts of this sport. Over time it has had a noticeable evolution, both in the case of tennis balls, rackets and playing surfaces. Thanks to advanced technology, these elements have been constructed differently and from new and improved materials that have changed the game of tennis today from the beginning.

However, these improvements also came at the cost of more and more injuries and complaints from professional players. Due to the constant changes in playing equipment, players were equally forced to make changes that often resulted in serious and often career-defining injuries.

## Authors' Contributions

All authors have equally contributed to this study.

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